DOE/EA-1417 (Draft)

ENVIRONMENTAL ASSESSMENT

INTEGRATED CONCEPTS & RESEARCH CORPORATION
AND
SYNTROLEUM CORPORATION

GAS-TO-LIQUIDS FUELS PRODUCTION AND DEMONSTRATION PROJECT

TULSA PORT OF CATOOSA, ROGERS COUNTY, OKLAHOMA

MARCH 2002

U.S. DEPARTMENT OF ENERGY
NATIONAL ENERGY TECHNOLOGY LABORATORY

National Environmental Policy Act (NEPA) Compliance
Cover Sheet

Proposed Action:
The U.S. Department of Energy (DOE) proposes to provide cost-shared financial support, through a cooperative agreement with Integrated Concepts & Research Corporation (ICRC) and Syntroleum Corporation, for construction and operation of a 70 barrel-per-day gas-to-liquids (GTL) fuels production plant at the Tulsa Port of Catoosa Industrial Park in Rogers County, OK. DOE would provide about 44% of the approximately $36 million cost of the project, which would comprise a 3-year effort under DOE support, with plant operation for 6 months. The GTL fuels production plant would use natural gas to produce near-zero sulfur content diesel fuel and other clean transportation liquids.

During the 6 months of operation for DOE, the plant would produce sufficient ultra-clean synthetic diesel fuel for fleet vehicle testing in Washington, D.C., and at the Denali National Park in Alaska. Diesel fuel product would also be produced for testing in advanced light- and heavy-duty engines. The plant may be operated for short time periods to produce synthetic jet fuel for testing as a candidate for aircraft engine applications. Following completion of the project with DOE, the plant could continue operating under private funding.

Type of Statement: Draft Environmental Assessment

Lead Agency: U.S. Department of Energy; National Energy Technology Laboratory (NETL)

DOE Contacts:

Project Information:
Jenny Tennant
NEPA Document Manager
U.S. Department of Energy
National Energy Technology Laboratory
P.O. Box 880
Morgantown, WV
304-285-4830; 304-285-4403 (fax)
jenny.tennant@netl.doe.gov (e-mail)

NEPA Information:
Lloyd Lorenzi
NEPA Compliance Officer
U.S. Department of Energy
National Energy Technology Laboratory
P.O. Box 10940
Pittsburgh, PA 15236-0940
412-386-6159; 412-386-4604 (fax)
lorenzi@netl.doe.gov (e-mail)

Abstract:
DOE's objective in participating in the cooperative agreement is to support demonstration of a technology potentially capable of producing ultra-clean transportation fuels, primarily clean, near-zero sulfur content diesel fuel for future transportation sector needs. The GTL fuels production plant would be installed within an industrial park possessing the required infrastructure and containing tenants that process or handle similar qualities and quantities of materials and chemicals.

The environmental analysis identified that the most notable changes to result from the proposed action would occur in the following areas: air emissions, construction impacts, ecological impacts, noise, and water discharges. No substantive adverse environmental concerns were identified in analyzing the potential consequences of these changes.

Public Comments:
DOE encourages public participation in the NEPA process. The public is invited to provide oral, written, or e-mail comments on this draft Environmental Assessment to DOE by the close of the public scoping period on March 25, 2002. Copies of the draft EA are also being distributed to cognizant Federal and state agencies. Comments received from public participation will be considered in preparing a final Environmental Assessment of the potential consequences of the proposed DOE action.

TABLE OF CONTENTS

Section **Page**

LIST OF FIGURES

Figure **Page**

LIST OF TABLES

Table **Page**

LIST OF ABBREVIATIONS AND ACRONYMS

amsl	above mean sea level
AQCR	Air Quality Control Region
ASTM	American Society of Testing and Materials
ATR	auto-thermal reformer
bbl	barrel(s)
bpd	barrels per day
Btu	British thermal unit
Btu/hr	British thermal units per hour
C	carbon
CAA	Clean Air Act
CAAA	Clean Air Act Amendments
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CO	carbon monoxide
CO_2	carbon dioxide
dB	decibel
dB(A)	A-weighted decibel scale
DOE	United States Department of Energy
EA	Environmental Assessment
EPA	Environmental Protection Agency
FBP	final boiling point
ft (FT)	feet
F-T	Fischer-Tropsch
FTR	Fischer-Tropsch reactor
gpd	gallons per day
gpm	gallons per minute
GTL	gas-to-liquids
HAPs	Hazardous Air Pollutants
hr	hour
IBP	initial boiling point
ICRC	Integrated Concepts & Research Corporation
lb (LB)	pounds
lb/hr	pounds per hour
L_{eq}	equivalent noise level
mg/l	milligrams per liter
mm	millimeters
MM	million
mph	miles per hour
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NETL	National Energy Technology Laboratory
NO_x	nitrogen oxides
NRHP	National Registry of Historic Places
NSPS	New Source Performance Standards
NWI	National Wetlands Inventory
O_3	ozone
ODEQ	Oklahoma Department of Environmental Quality

Pb	lead
PM_{10}	particulate matter with a size of 10 microns or less
POTW	publicly owned treatment works
psia	pounds per square inch (absolute)
SCF	standard cubic feet
SHPO	State Historic Preservation Office(r)
SO_2	sulfur dioxide
SWPPP	Storm Water Pollution Prevention Plan
tpy (TPY)	tons per year
USACE	United States Army Corps of Engineers
U.S.C.	United States Administrative Code
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
VOC(s)	Volatile Organic Compounds
WMATA	Washington (DC) Metropolitan Area Transit Authority
wt	weight
WVU	West Virginia University
$\mu g/m^3$	micrograms per cubic meter
^oF	Fahrenheit degrees
^oC	Centigrade degrees

1.0 INTRODUCTION

This Environmental Assessment (EA) provides the results of a study on the potential environmental impacts from construction and operation of a gas-to-liquids (GTL) fuels production plant that would be operated to produce (nominally) 70 barrels per day of ultra-clean transportation fuels, primarily near-zero sulfur content diesel fuel, from natural gas. If approved, the U.S. Department of Energy (DOE) would provide approximately 44% of the funding required to demonstrate both the technical performance of the technology and the environmental and efficiency advantages of using the diesel fuel product in fleet vehicles and other engine tests.

The proposed action is cost-shared financial support by DOE, through a cooperative agreement with Integrated Concepts & Research Corporation (ICRC) and Syntroleum Corporation, for construction and operation of a 70 barrel per day GTL fuels production plant at the Tulsa Port of Catoosa Industrial Park in Rogers County, OK. DOE would provide approximately $16 million of the $36 million cost of the project, which would comprise a 3-year effort, including plant operation for 6 months. The plant would be operated to produce sufficient ultra-clean synthetic diesel fuel for fleet vehicle testing in Washington, D.C., and in the Denali National Park in Alaska.

The purpose of the EA is to determine if the proposed action could potentially cause significant impacts to the environment. If potentially significant environmental impacts are identified, and if they cannot be reduced to insignificance or avoided, then a more detailed Environmental Impact Statement would be prepared. If no significant environmental impacts are identified, a Finding of No Significant Impact would be prepared and made available to the public, along with the EA itself, before the proposed action proceeds.

This study was prepared in accordance with the National Environmental Policy Act (NEPA) of 1969 (42 United States Code 4321 *et seq*.), the Council on Environmental Quality's Regulations [Title 40, Code of Federal Regulations (CFR), Parts 1500-1508], and Department of Energy's NEPA Implementing Procedures (Title 10, CFR, Part 1021).

2.0 PURPOSE AND NEED

Syntroleum Corporation and the U.S. Department of Energy (DOE) are considering development of a small-scale gas-to-liquid fuels plant at the Tulsa Port of Catoosa Industrial Park, near Tulsa, Oklahoma. This Environmental Assessment (EA) is part of the environmental impact analysis process for the proposed action. The EA addresses requirements of the National Environmental Policy Act (NEPA) of 1969 (Public Law 91-190) as well as subsequent executive orders, Council on Environmental Quality (CEQ) guidelines, and DOE's NEPA Implementing Procedures (10 CFR 1021).

2.1 PURPOSE AND NEED FOR AGENCY ACTION

The United States Government, through the Department of Energy's National Energy Technology Laboratory (NETL), is sponsoring a program to develop, manufacture, and test a new generation of ultra-clean transportation fuels for cars, trucks and other heavy vehicles. The goals of this program are to:

- Reduce the United States' dependency on foreign crude oil through efficient, economic, and environmentally friendly exploitation of the nation's fossil fuels;
- Produce liquid fuels that are compatible with the transportation infrastructure and that are formulated to enable advanced, high efficiency engines to achieve ultra-low emissions; and
- As an alternative to domestic petroleum exploitation, develop technologies capable of converting domestic resources to clean fuels that would supplement petroleum in satisfying the Nation's growing demand for cleaner transportation fuels.

New environmental standards for motor vehicle diesel fuel are scheduled for phase-in beginning in 2006. This proposed action would support demonstration of a technological solution that would provide fuel producers with an economical approach to meet the new standards.

2.2 BACKGROUND

Under fiscal year 2000 competitive solicitation DE-PS26-00NT40758, Ultra-Clean Transportation Fuels, DOE requested cost-shared applications for research and development in three fuels-related areas. One of those areas was for "the production of ultra-clean transport fuels from fossil resources, and the validation of their performance by testing in engines."

In response to that solicitation, Integrated Concepts & Research Corporation (ICRC) assembled a team comprised of Syntroleum Corporation, University of Alaska, Daimler-Chrysler Corporation, West Virginia University, Massachusetts Institute of Technology's Sloan Automotive Laboratory, and Arthur D. Little, Inc., for preparing a proposal on diesel fuel, which is subject to new U.S. Environmental Protection Agency (EPA)-promulgated fuel quality regulations. Specifically, the new regulations would require domestic fuel producers to apply new technology capable of achieving 97% reduction in sulfur content of marketed diesel fuel.

One approach to produce low-sulfur diesel is to use natural gas, rather than petroleum, as the starting material. Stranded gas fields, such as the large gas field on the North Slope of Alaska, could provide a potentially important source of this feedstock. The proposed effort consists of construction and operation of a plant that uses gas-to-liquids (GTL) technology to convert natural gas to ultra-clean diesel fuel for performance testing and demonstration in engines and fleet vehicles.

Since sulfur deactivates catalysts that would be used in the process, the natural gas feed would be cleaned to an inherently sulfur-free feedstock. The GTL fuels production technology produces fuels containing

contaminant levels below all existing and proposed fuel sulfur limits. The proposed technology would be particularly applicable to processing natural gas that is currently vented at remote oil fields.

Syntroleum Corporation is the developer and owner of proprietary technology (the Syntroleum Process) for converting natural gas into synthetic liquid hydrocarbon fuels and specialty products, and Syntroleum licenses this process to oil companies for use in making synthetic fuels. Syntroleum's GTL technology converts natural gas into synthetic liquids in a two-step process. In the first step, natural gas is reacted with air in a proprietary auto-thermal reformer reactor to produce a nitrogen-diluted synthesis gas (primarily a mixture of carbon monoxide and hydrogen). In the second step, the synthesis gas is processed into synthetic oil using technology based on Fischer-Tropsch chemistry in a reactor containing a proprietary catalyst developed by Syntroleum. The synthetic oil is then refined into synthetic fuels, including diesel and low octane gasoline. The produced diesel fuel is compatible with the existing fuels infrastructure, is virtually free of sulfur and aromatic components, has a high cetane level, and achieves the quality requirements of environmental regulations expected to take effect in 2006.

Following demonstration of key components of a gas-to-liquids process in laboratory operations, initial patents for the technology were issued to Syntroleum in 1989 and 1990. Construction of a pilot-scale facility was completed in 1990 and operations were conducted through 1991. Between 1991 and 1995, research and development efforts were focused on developing more effective catalysts. The pilot facility was modified in 1995 to test new catalysts and in 1997 to test new reactor configurations. In July 1999, natural gas-to-liquids processing equipment with a capacity of 70 barrels per day was successfully tested at the ARCO (now BP) Cherry Point Refinery near Bellingham, Washington. Syntroleum also demonstrated product upgrading technology at the pilot plant scale. The equipment from the Cherry Point Refinery is available for use at the Tulsa Port of Catoosa Industrial Park to provide basic process components for the proposed production plant.

Synthetic liquid fuels produced by Syntroleum's technology have been evaluated in laboratory and limited road testing since 1997. Based on this testing, the produced liquid fuels received approval in 2000 by the EPA for use as transportation fuels. GTL fuels produced domestically received certification as "Alternative Fuels" under the Energy Policy Act. Syntroleum's synthetic fuels have also been demonstrated in fuel cell applications at DOE's Argonne National Laboratory and by fuel cell manufacturers.

The proposal submitted by the ICRC and Syntroleum Corporation team in resp9onse to DOE's competitive solicitation (DE-PS26-00NT40758) contained the following objectives:

- Complete detailed mechanical design, build, and operate a modular, small plant to convert natural gas, via Fisher-Tropsch (F-T) and hydro-processing reactions, into hydrogen-saturated diesel fuel.
- Conduct the following fuels tests:
    1. Diesel fuel in a variety of engines and vehicles to ensure that use of the product would result in acceptable compatibility with fuel injection system components and reduced emissions.
    2. Diesel fuel in prototype engines to demonstrate compatibility with next-generation exhaust after-treatment emission control systems, especially for NO_x and particulate reduction.

The final stage of the proposed project was to perform an economic analysis using data obtained from the project to predict commercial viability. Table 2-1 identifies the currently anticipated participants in this GTL project and their respective responsibilities and interests.

DOE selected the proposed project, for building and operating a GTL fuels plant and demonstrating performance of product fuels in engine and fleet vehicle demonstration tests, for support, since the

proposed technology, if successfully demonstrated and applied, could potentially achieve the following results:

- Use domestic resources that are readily available in quantities sufficient to support requirements for the large domestic automotive and/or truck fleets;
- Yield ultra-clean designer fuels, free of both sulfur and aromatic compounds, that are compatible with both existing and new automotive and truck engine designs;
- Fit seamlessly into the existing distribution infrastructure; and
- Provide an environmentally friendly operation during the fuels production phase.

Table 2-1. Project Participants

PARTICIPANT	RESPONSIBILITY	OBJECTIVE(S)	COST SHARE
Integrated Concepts & Research Corporation (ICRC)	Overall management of the proposed project; dynamometer tests of diesel bus engines; monitor fleet vehicle testing	Prime Contractor	
Syntroleum Corporation	Engineering, construction, and operation of the GTL plant; production of fuel for demonstration testing	Produce hydrogen-saturated Fischer-Tropsch fuels and demonstrate performance; license GTL technology	Co-fund
Marathon Oil Company	Technical and project management support	Acquire GTL engineering and operations expertise	Co-fund
National Park Service	Fleet vehicle tests at Denali National Park	Acquire information on performance of clean diesel fuel for meeting future standards	
Washington (DC) Metropolitan Area Transit Authority	Fleet vehicle tests in Washington, D.C.	Acquire information on performance of clean diesel fuel for meeting future standards	
West Virginia University	Emissions measurements during fleet vehicle testing	Generate information on comparative emissions of GTL and conventional diesel fuels	
Daimler-Chrysler Corporation	Evaluation of fuels in prototype light- and heavy-duty diesel engines	Demonstrate compatibility of fuels with next-generation engine control systems	Co-fund
University of Alaska, Fairbanks	Testing of ultra-clean diesel fuels	Generate information on use of ultra-clean diesel fuel	
Massachusetts Institute of Technology	Optimization testing of engine combustion systems	Identify engine operability improvements for using ultra-clean diesel fuel	
Arthur D. Little, Inc.	Economic and energy analyses	Establish the economic viability of using GTL technology for providing ultra-clean transportation fuels	
U.S. Department of Energy	Co-fund GTL facility construction and operation and fuel demonstration tests	Demonstrate production and performance of ultra-clean fuels	44%

2.3 SCOPE OF THE ENVIRONMENTAL ANALYSIS

Environmental resources considered to be the primary issues for the proposed action include threatened and endangered species, noise, water resources, geology and soils, site infrastructure, transportation, visual resources, air quality, waste management, socioeconomics, cultural resources, Native American concerns, and cumulative impacts.

Consideration of safety and health impacts is limited to potential accidental environmental releases that could affect workers and the public. All personnel and contractors that would participate in construction and operation of the proposed facility would be responsible for compliance with applicable Occupational Safety and Health Administration regulations concerning occupational hazards and protective measures for employees.

3.0 ALTERNATIVES, INCLUDING THE NO ACTION ALTERNATIVE

3.1 ALTERNATIVES TO BE CONSIDERED

Alternatives considered in this Environmental Assessment are limited to the Proposed Action and the No Action Alternative. The Proposed Action results from consideration of a proposal submitted by Integrated Concepts & Research Corporation (ICRC) and Syntroleum Corporation for a project to demonstrate gas-to-liquids technology. The proposal established the scope and location of a project designed to meet U.S. needs for technological advancement in the production of ultra-clean transportation fuels for cars, trucks, and other heavy vehicles. The decision to be made is whether or not to provide funds for supporting the proposal, based on its merit in meeting U.S. needs and considering the potential environmental consequences of the project. Thus, no alternatives to the Proposed Action, other than the No Action Alternative, are considered by DOE in this Environmental Assessment.

3.2 NO ACTION ALTERNATIVE

Under the No Action Alternative, DOE would not provide funds to support the project proposed by ICRC and Syntroleum. Implementation of this Alternative would probably result in termination of plans for the proposed project, in which case an opportunity for near-term development of ultra-clean transportation fuels would not be achieved. The proposed 10-acre project site at the Tulsa Port of Catoosa Industrial Park would remain available for other industrial or commercial tenants.

3.3 THE PROPOSED ACTION

The DOE, through the National Energy Technology Laboratory (NETL), proposes to provide funds to ICRC for developing a gas-to-liquids (GTL) technology fuels production and demonstration project. This project was proposed to DOE/NETL for co-funding under a DOE program for development of technology to produce ultra-clean transportation fuels using low-cost, domestic fuel resources.

The proposed GTL system would be based on synthesis gas production and Fischer-Tropsch (F-T) technologies previously demonstrated by Syntroleum Corporation at the Cherry Point Refinery near Bellingham, Washington, and on product upgrading technology demonstrated by Syntroleum in various pilot plant facilities. The proposed plant would produce (nominally) 70 barrels per day (bpd) of ultra-clean fuel, consisting of about 54 bpd of Syntroleum diesel and 14 bpd of synthetic naphtha. This technology uses air rather than oxygen in the process, thus avoiding the high cost and added complexity of an oxygen production plant.

Diesel fuel produced by the proposed GTL plant would be tested in various engines, including fleet tests in buses. The Washington (DC) Metropolitan Area Transit Authority (WMATA) and Denali National Park bus fleets were chosen to evaluate diesel fuels, primarily because they represent nearly opposite ends of several spectra when considering climate, topography, engine load factor, mean distance between stops, and composition of normally used conventional diesel fuel. Also, the operators of these fleets share the strong desire to participate in a program aimed at minimizing exhaust emissions, especially emissions that are most apparent to riders, people in other vehicles, and by-standers.

Previous research by Syntroleum has shown that extremely low-sulfur, high-quality diesel fuels significantly reduce exhaust emissions from current diesel engines. The ultra-clean, hydrogen-saturated F-T fuels to be produced in the proposed project would have virtually no sulfur (less than 1 part per million) and would provide extremely high quality fuel in terms of ignition quality, saturate content, backend volatility, etc. However, these fuels lack lubricity and could cause compatibility problems with

legacy fuel injection system components, in the absence of appropriate additives and formulation technology. With future improvements to the diesel engine, this may not be a problem. Tests would be run on prototype diesel engines equipped with exhaust after-treatment emission control systems to determine how well those future engine systems would perform with an ultra-clean F-T diesel fuel, both neat and blended.

The proposed plant would also produce synthetic naphtha (in addition to synthetic diesel fuel), which would provide an opportunity for additional ultra-clean fuels study, since hydrogen-saturated naphtha would be an ideal fuel for fuel cell systems that use a reformer to produce hydrogen.

3.3.1 Proposed GTL Fuels Production Plant

The proposed action is for DOE, through a three-year cooperative agreement between the NETL and ICRC (and ICRC's team), to share the cost of testing technology developed by Syntroleum Corporation for conversion of natural gas to liquid fuels, particularly diesel fuel. The goals of the agreement would be to:

- Produce test quantities of ultra-clean synthetic transportation fuels
- Demonstrate use of synthetic fuels in test engines and fleet vehicles
- Evaluate performance of the synthetic fuels in advanced engines and emission control technologies

To provide fuels for engine testing, Syntroleum Corporation, in coordination with Marathon Oil Company, would produce ultra-clean synthetic fuels using Syntroleum's GTL technology. Syntroleum previously tested similar GTL synthetic oil production in equipment operated at the Cherry Point Refinery in the State of Washington. The equipment would be installed at an undeveloped, partially wooded site in the Tulsa Port of Catoosa Industrial Park and used to provide the key process components for the GTL fuels production plant. New modules would be added to enable production of finished fuels. The project area is not characterized by farmlands or special management areas. The proposed site is not located within the 100-year or 500-year floodplains, and no wild or scenic rivers are located in the area of project influence.

The produced diesel fuel would be tested in engines and vehicles to establish compatibility with fuel injection system components and to determine the effects on emissions. The fuel would also be tested in prototype engines to demonstrate compatibility with next-generation emission control systems, with particular focus on NO_x and particulate emissions.

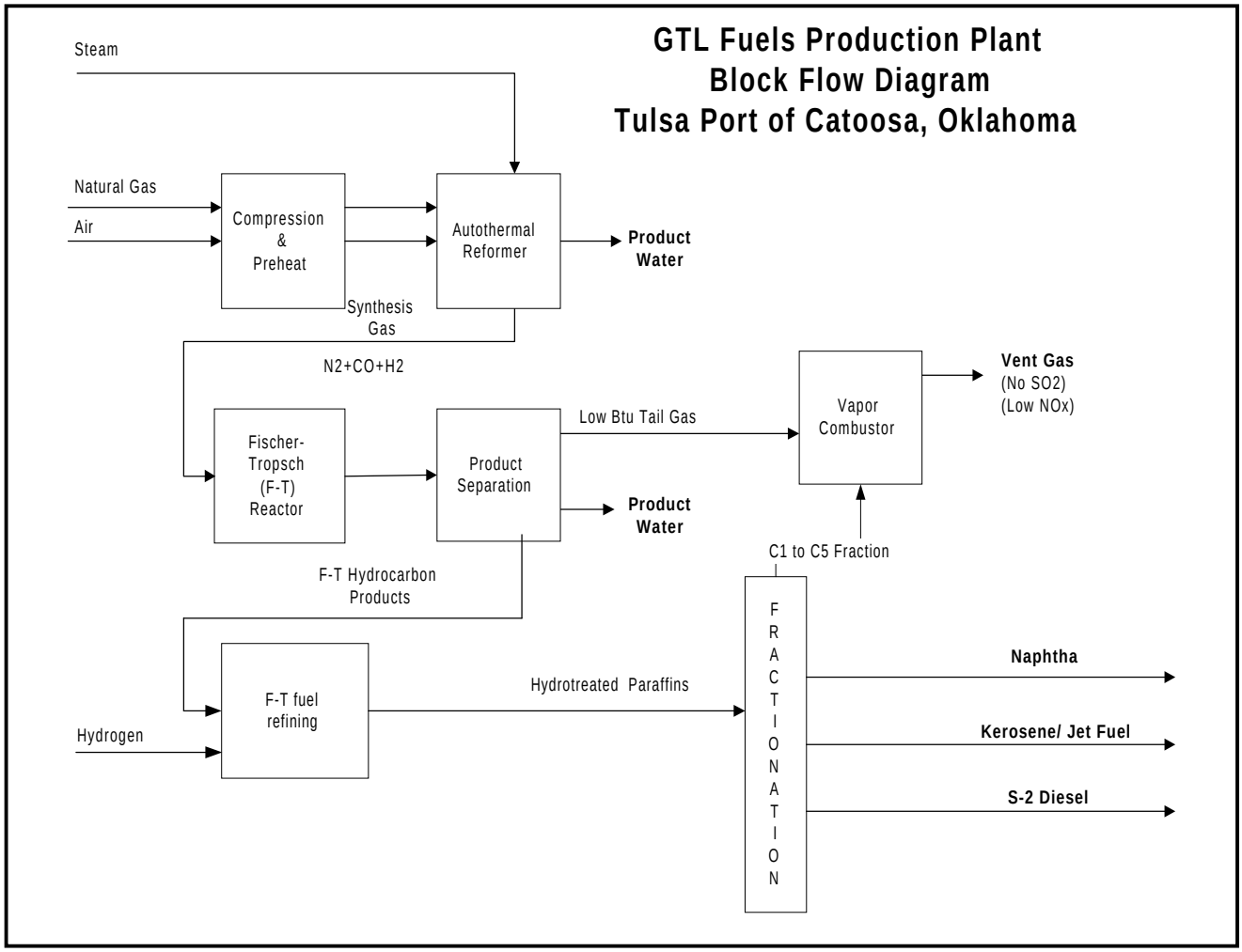
ICRC would conduct dynamometer testing of diesel bus engines and oversee vehicle tests. An automobile company (DaimlerChrysler Corporation) would evaluate product fuels in prototype light and heavy-duty diesel engines combined with exhaust after-treatment systems. Two candidate transportation systems for diesel fuel testing include the Washington (DC) Metropolitan Area Transit Authority and the Denali National Park bus fleet. GTL diesel fuel would contain virtually no sulfur (less than 1 part per million) and possess high quality in terms of ignition quality and volatility. However, problems could occur due to potential compatibility problems with fuel injection system components, and the engine tests would provide information to determine and mitigate potential compatibility problems.

3.3.1.1 Project Description

The proposed gas-to-liquids plant would produce approximately 70 bpd of synthetic fuels – about 2,300 gallons per day (gpd) of ultra-clean diesel fuel for engine testing and about 600 gpd of sulfur-free synthetic naphtha, which could be used in fuel cell testing programs. Under specialized operating conditions, the production capacity of the plant could be increased to about 90 bpd.

Figure 3-1 presents a block flow diagram of the proposed GTL plant. In this GTL plant, natural gas would be reacted with air in a proprietary auto-thermal reformer (ATR) reactor to produce a nitrogen-diluted "synthesis" gas, consisting primarily of carbon monoxide and hydrogen. A proprietary catalyst would be used to convert the synthesis gas into synthetic hydrocarbons, referred to as synthetic crude oil, in a Fischer-Tropsch reactor (FTR). Hydrotreating and hydrocracking technology would be used to convert the synthetic crude into sulfur-free, clean transportation fuels. By-product gases would be eliminated in a vapor combustor. Tail gas or undesirable by-products, which would contain ammonia, methanol, pentane, and hexane, would be sent to the 98%-efficient vapor combustor.

Figure 3-1. Block Flow Diagram of the Proposed GTL Fuels Production Plant



Construction of the proposed plant would require approximately 9 to 12 months following completion of mechanical design. Following construction, the plant would undergo start-up activities for approximately 2.5 months. Start-up activities would be planned to demonstrate the following:

- Sustained operations using natural gas
- Operational safety
- Continuous production of high quality fuels that meet the specification included in Table 3-2

Following start-up, the plant would be operated for approximately 4 additional months to provide the fuel types and volumes required for fleet and vehicle demonstrations and fuel/engine technology development tasks. Up to10,000 gallons of fuel product would be made to the Jet A-1 specification of ASTM D-1655 and would be provided to NETL. This fuel would be available for use in test programs with other DOE partners. ICRC would develop a fuel production and distribution plan, including:

- Specifications for the types of fuels to be produced
- Schedule for producing the desired types of fuels in the quantities required for evaluation
- Destinations for the fuels, including type and quantity
- Fuel storage and distribution requirements to support the fleet tests

Up to 25% of the operating hours of the proposed plant during the DOE project (i.e., up to about one week per month) may be used for fuels production outside the scope of the DOE program. Such intervals would be designated by Syntroleum but would be coordinated with the DOE program to ensure that operations for Syntroleum would not impair the achievement of DOE's project objectives.

Under the DOE agreement, the GTL plant would be operated to produce the following quantities of fuel:

- 10,000 gallons of Jet A-1 fuel
- 150,000 gallons of S-2 diesel fuel meeting the diesel specification included on Table 3-2

If additional quantities of diesel fuel should be needed to complete fuel testing, the proposed plant would be operated to provide additional specification fuel. Storage requirements at the proposed site would exist for compressed hydrogen gas, pressurized liquid nitrogen, and liquid fuel products. The anticipated feedstock and product storage requirements are shown in Table 3-1.

Storage tanks, with a maximum fuel storage potential of 262,500 gallons, or 6,250 barrels (bbl), would be contained within a concrete dike sized for 110% of the largest tank volume, plus stormwater. All process areas would be provided with spill containment. The ATR/FTR reactor units would be exposed to stormwater. Hydrotreating and hydrocracking units would be housed within a partially enclosed structure (roof and partial sidewalls) that would provide spill containment in the event of an accidental release.

Table 3-1. Feedstock Material & Product Storage

TANK NUMBER	HEIGHT (FT)	DIAMETER (FT)	CAPACITY	CONTENTS
1	7	8	2,520 gallons	Naphtha
2	7	8	2,520 gallons	Naphtha
3	11	13	10,080 gallons	Diesel
4	11	13	10,080 gallons	Diesel
5	14	16	18,900 gallons	Naphtha
6	14	16	18,900 gallons	Naphtha
7	14	16	18,900 gallons	Naphtha
8	14	16	21,000 gallons	Re-run
9	14	16	21,000 gallons	C10+
10	19	25	69,300 gallons	Diesel
11	19	25	69,300 gallons	Diesel
Pressure Vessels (3)			≤275,000 standard cubic feet	Compressed Hydrogen Gas
Pressure Vessel			5,000 gallons	Pressurized Liquid Nitrogen
ISO Containers (maximum of 67)			6,341 gallons/container	Diesel

Construction activities would include removal of existing vegetation, removal and storage of existing topsoil, plant construction, paving, and installation of new landscaping. The proposed project site is currently vegetated with woodlands. Existing vegetation surrounding the project area would not be altered. Upon completing construction activities, the project area would be replanted in a manner typical of other developments at the Tulsa Port of Catoosa Industrial Park. Site preparation and construction would begin in 2002, and all construction activities would conform to applicable building and utility codes.

Using DOE funds, the plant would be operated for 6 months, during which time the total anticipated fuel production would be 8,800 bbl of ultra-clean diesel fuel and 560 bbl of ultra-clean naphtha. Syntroleum could continue to operate the plant following completion of the 6-months of DOE-funded work.

3.3.1.2 Project Location

The proposed project would be located on approximately 10 acres of property within the boundaries of the Tulsa Port of Catoosa Industrial Park. The proposed site is located in the southeast quadrant of the northeast quarter of Section 6, Township 20 North, Range 14 East, in Rogers County, Oklahoma. The location of the site is depicted in Figures 3-2 and 3-3.

The Industrial Park is a 2,000-acre property approximately 3 miles from the central business district of Catoosa, OK, with a population of 2,950, and approximately 12 miles from the central business district of Tulsa, OK, with a population of 386,000. The Industrial Park offers prime industrial sites for lease and is supported by barge, truck, rail, and other modes of transportation. Approximately 50 corporate enterprises employing 2,600 people are currently located in the Industrial Park.

The Tulsa Port of Catoosa (Port) is an international shipping port and intermodal transportation center in northeast Oklahoma, at the head of the McCellan-Kerr Arkansas River Navigation System. Within the Industrial Park at the Port are industrial operations involving bulk liquids handling, agricultural product distribution, chemical production, metals fabrication, and primary steel processing. Specifically, tenants currently located within the Industrial Park conduct the following types of business operations:

- Agricultural products blending and storage
- Fertilizer storage and distribution
- Grain storage and shipment
- Nitrogen-based fertilizer manufacture
- Bleach manufacture
- Chlor-alkali product storage and distribution
- Refined oil storage
- Manufacture of asphalt emulsions for pavement
- Storage and distribution of liquid petroleum products
- Manufacture of inorganic and specialty chemicals (e.g., inorganic fluorine chemicals)
- Production of automotive catalysts
- Production of ultra-high purity gas
- Metal fabrication for heat exchangers, storage tanks, and drilling rigs
- Steel coil processing for production of steel sheets and plates

The proposed 10-acre site for the GTL plant is a currently undeveloped, gradually sloping, and irregular tract of land at the northwest boundary of the Industrial Park. Land surface at the site slopes from an elevation of approximately 625 feet above mean sea level (amsl) at the northwest boundary to 595 feet amsl at the southeast boundary. Rail transport and waterfront terminal capabilities are conveniently available at the Industrial Park.

Figure 3-2. Site Location; Tulsa Port of Catoosa Industrial Park

Figure 3-3. GTL Plant Location; Tulsa Port of Catoosa Industrial Park

Utilities available at the project site include electric service from American Electric Power, natural gas service via a 16-inch supply line from Oklahoma Natural Gas, and Water Supply and Treatment via the City of Tulsa municipal water systems. Additional infrastructure available at the Industrial Park includes outdoor staging areas for construction equipment and a full-service occupational health clinic, complete with helipad. Highway access is available via controlled-access gates and after-hours security.

The Tulsa Port of Catoosa Industrial Park was selected as the site for the proposed project for several reasons. The primary benefit of the selected site is the variety of available transportation options. In addition to being an international waterway, the Port also has rail facilities. The proposed location has access to high-pressure natural gas lines and electrical power, both of which are required by the proposed GTL plant.

3.3.2 Proposed Fuels Utilization

ICRC would conduct multiple demonstrations and tests of fuels produced by the GTL plant, including demonstrations in two different bus fleets and in prototype engines using advanced power train and emission control technologies. The diesel fuel tests would be planned to evaluate operability and potential for reducing exhaust emissions in diesel engines. The demonstrations and tests would be performed by project participants, including DaimlerChrysler, Washington (DC) Metropolitan Area Transit Authority, Massachusetts Institute of Technology's Sloan Automotive Laboratory, University of Alaska, and West Virginia University's transportable emissions testing laboratory. In addition, Arthur D. Little would perform a wellhead-to-wheels economic analysis of the potential for the fuel to enter the transportation market.

For the DOE program, up to 10,000 gallons of fuel product would be made to Jet A-1 specification and used in test programs with other stakeholders identified by DOE to determine potential for aircraft use. The DOE program would also provide for production of 150,000 gallons of specification diesel fuel, which would be used for vehicle and vehicle-related tests.

Dynamometer durability engine tests using a new diesel bus engine representative of engines used in the Washington DC Metropolitan Area Transit Authority fleet test would be performed for up to 1,500 hours. Engine inspections would be performed before and after testing for fuel lubricity, seal compatibility, and cold-temperature problems. Testing for compatibility with conventional diesel fuel would also be monitored. A second, 1,500-hour dynamometer test would be performed using a new diesel bus engine representative of the engines used in the bus fleet at Denali National Park. Similar engine and fuel tests would be conducted in the two dynamometer studies.

Three buses in each of the two fleets would be used to field test the diesel fuels. Each bus would be matched to a bus of the same type operated with conventional diesel fuel in similar service within each fleet. Data collected from the fleet tests would include operating time and travel distance, fuel consumption, engine oil degradation, and ambient conditions. Exhaust emissions would be determined during the fleet tests.

The diesel fuel would also be tested in advanced prototype light-duty and heavy-duty engines, and both emissions and operability would be compared to engines using conventional diesel fuels. Tests in engines equipped with prototype exhaust after-treatment devices for particulates and nitrogen oxides would be conducted.

GTL fuels are highly paraffinic, high-cetane synthetic distillate products suitable for use in fuel cell and compression ignition engine applications. The technical viability and commercial feasibility of using produced naphtha as a candidate fuel for automotive fuel cells may also be determined through laboratory

fuel cell studies. Environmental performance of the GTL diesel fuel would be compared to the emissions that would result from combustion of conventional diesel fuel.

Typical characteristics of the synthetic diesel fuel (Syntroleum S-2) to be produced from the proposed GTL plant are presented in Table 3-2. Both the synthetic diesel fuel and the synthetic jet fuel that would be obtained from the proposed facility would be composed of saturated (>99%) paraffin components, which are minimally soluble in water and highly biodegradable, thus possessing characteristics relatively benign to the environment.

Table 3-2. Characteristics of Syntroleum Synthetic Diesel Fuel, S-2

PHYSICAL PROPERTY	TEST METHOD	UNITS	TYPICAL VALUE
Specific Gravity	ASTM D-1298		0.771
API Gravity	ASTM D-1298	°	52.0
Flash Point	ASTM D-93	°F (°C)	148 (64)
Cloud Point	ASTM D-2500	°F (°C)	<0 (<-18)
Color	ASTM D-1500		L0.5
Sulfur	ASTM D-2622	Wt%	Not detected
Viscosity	ASTM D-445		
@ -20°C		CSt	10.3
@ 40°C		CSt	2.1
@100°C		CSt	1.0
Carbon Residue	ASTM D-524	Wt%	Not detected
Copper Strip	ASTM D-130		1a
Aromatics	ASTM D-1319	Vol%	Not detected
Olefins	ASTM D-1319	Vol%	Not detected
Saturates	ASTM D-1319	Vol%	>99%
Cetane Number	ASTM D-613		>74
Distillation,	ASTM D-86		
IBP, vol %		°F (°C)	320 (160)
10 %		°F (°C)	390 (199)
50 %		°F (°C)	493 (256)
90 %		°F (°C)	601 (316)
FBP, vol %		°F (°C)	662 (350)
Lubricity	ASTM D-6079	mm	<0.37
Ash	ASTM D-482	wt%	<0.001

3.3.2.1 Bus Fleet Demonstrations of GTL Synthetic Diesel

Three buses in two fleets (a total of six buses) would be used to field test the F-T diesel fuel produced by the GTL plant. Each set of three test buses would be matched to three buses of the same type in the same fleet running on conventional diesel fuel and providing service that would be as similar as possible. Separate fueling facilities and fueling regimens would be established for the field tests and monitored closely to maintain the integrity of the GTL and conventional diesel fuels. The buses would also be marked with simple, easy-to-understand panels identifying the project, the project sponsors, and the purpose of the project, and both web site and telephone contacts for obtaining additional information would be identified. During the fleet tests, the buses would be monitored for any problems that might occur. Data from the fleet tests (including operating time and travel distance, fuel consumption, engine

oil degradation, and pertinent ambient conditions) would be catalogued, reduced, and analyzed. Whenever possible, appropriate action would be taken to correct vehicle problems and continue the fleet tests.

The ultra-clean diesel fuel, with appropriate additives, would be tested in buses from each fleet during normal service, for a period of about six months in each fleet. One fleet test would occur in urban transit service buses from the Washington (DC) Metropolitan Area Transit Authority (WMATA). The other fleet test would occur at the opposite end of several spectra (i.e., climate, topography, load factor, etc.), in the Denali National Park bus fleet in Alaska.

Both bus fleets operate under the auspices of government authorities, and they, as well as the individuals charged with running and maintaining the buses on a daily basis, strive to minimize emissions and the overall environmental impact of fleet operations. Both fleets either use, or have a phase-in plan to begin using, relatively low-sulfur conventional diesel fuels (occasionally referred to as "city diesel" or "CARB diesel," for California Air Resources Board) that are currently available at a premium price.

The three buses in each fleet, operating for a period of six months (or one season in Denali National Park, from May through September), would consume a maximum of 24,000 gallons of near-zero sulfur, zero aromatic content GTL fuel. This fuel would displace approximately the same amount of conventional fuel that would otherwise be used - the energy content of synthetic diesel is 1% to 6% less than conventional #2 diesel. The three buses in each fleet would perform normal service for their fleet. The only additional running for the fleet-test program would be the exhaust emission testing on the three GTL-fueled buses and the three control buses in each fleet that would use conventional fuel.

The GTL diesel fuel would be handled by the installed fuel infrastructure in each of the demonstration localities. However, for the purposes of this program, the GTL fuel would be segregated from the conventional fuel system to maintain purity.

3.3.2.2 Exhaust Emission Testing of the Buses

Engine emission testing would be performed by West Virginia University (WVU), which has pioneered development of a transportable heavy-duty vehicle exhaust emission measurement laboratory. Bus emissions would be evaluated on a portable heavy-duty chassis dynamometer, which allows the drive wheels to spin freely, while test-shafts connecting the wheel hubs to a computer-controlled dynamometer on each side of the bus would allow the engine and drivetrain to be loaded according to a prescribed driving speed and load cycle. Exhaust emission sampling systems and analysis methods would be designed and operated in accordance with industry-accepted standards, to obtain representative emission results for particulates, oxides of nitrogen, hydrocarbons, and carbon monoxide. The ultimate objective of these tests would be to determine the effect of improved fuel properties on real-world exhaust emissions.

Exhaust emissions would be tested on two occasions during the fleet tests. As the buses begin operations, exhaust emissions from each of the six buses in each fleet (12 buses in total) would be measured. At the end of the fuel evaluation field test program, exhaust emissions from all six buses in the WMATA field test would again be measured by WVU.

3.3.2.3 Fuel System Durability Tests on an Engine Dynamometer

Although undesirable from a combustion and emissions standpoint, sulfur and aromatics in fuel can provide some protection to hard steel surfaces during the equipment movement that occurs in high-pressure pumping and fuel injector assemblies. To provide additional protection for metal surfaces, petroleum chemical companies have developed effective fuel additive packages, sometimes called

lubricity additives. These additive packages are both needed and effective for fuel testing programs that use relatively ultra-low sulfur and aromatic diesel fuels.

The composition of GTL fuel is virtually 100% saturates, normal and iso-paraffins, with no sulfur or aromatics compounds. Even with appropriate levels of proven additives, and with a limited history of trouble-free use in other engines, the GTL fuel could present a more severe operating environment for the fuel system in a long term field test. Potential incompatibility of the fuel with existing elastomer seals in some fuel systems, if experienced, could also eventually lead to fuel leakage, either from increased seal-swell with subsequent seal wear or, conversely, from seal-shrinkage. Thus, two 1,500-hour fuel-system dynamometer durability tests would be run on two engines representative of the WMATA and Denali bus fleets.

The dynamometer testing would be performed using fuel with the same additives that would be used during the fleet tests. These tests would result in collection of data on fuels representative of those to be produced from the proposed GTL plant. Early performance testing could also provide evidence that the ultra-clean diesel fuel would not cause operational problems. The engines would be inspected during and after the tests. The engines would be closely monitored for the following:

- Insufficient fuel lubricity, which could cause damage to fuel-injection system components
- Seal compatibility or seal-swell differences between F-T and conventional diesel fuels, which could cause leaks or other problems
- Cold-temperature problems such as filter-plugging, etc.

Fuel incompatibility, which could occur with blends of F-T fuels and conventional diesel, would be monitored with separate equipment. If any significant problems occur during the tests, alternative solutions would be identified and validated before proceeding with the bus fleet tests.

These two dynamometer tests would each use approximately 24,000 gallons of fuel. ICRC employees, using ICRC test facilities that are co-located within test laboratories in Plymouth and Ann Arbor, Michigan, would run the tests. The laboratories are commonly used for engine development and emissions testing. These laboratories comply with all applicable state and local laws and regulations regarding performance and emission testing of engines on dynamometers.

3.3.2.4 Evaluation of GTL Fuel in Prototype Diesel Engine and Emission Control Systems

The ultra-clean diesel fuel would be tested in advanced prototype light- and heavy-duty engines to achieve the following:

- Compare performance with conventional diesel fuels in terms of both emissions and operating functions
- Compare performance with other available low sulfur fuels in diesel engines equipped with prototype exhaust after-treatment devices used to reduce particulate and NO_x emissions
- Investigate the effects that addition of various low levels of aromatics to the ultra-clean diesel fuel would have on performance degradation with respect to emissions and emission control systems

This evaluation would be conducted over a sufficiently long operating interval to observe any potential effects that fuel properties might have on degradation of emission control efficiency. Both heavy-duty and light-duty engines would be tested.

DaimlerChrysler, and its subsidiaries Detroit Diesel and Freightliner, would perform the extended-duration tests on prototype engines and emission control systems as part of their on-going diesel engine and emission control system development efforts. Testing would be conducted on heavy-duty diesel engine dynamometers at Detroit Diesel's laboratory in Detroit, Michigan, and at Daimler's light-duty diesel vehicle emission lab and test-track in Germany.

These tests would be run for time durations that the DaimlerChrysler groups typically use to determine the practicality of a particular emission control concept. Approximate test durations would be a few hundred hours of dynamometer testing, or a few tens-of-thousands of vehicle-miles on the test track, with frequent intermediate determinations of exhaust emissions. Single or multiple engines and/or vehicles could be used.

The quantity of fuel that would be consumed in this type of prototype system testing is estimated to be 15,000 gallons.

3.3.2.5 Economic Analysis

Arthur. D. Little, Inc., would provide a well-to-wheels economic and market analysis of small GTL plants and an evaluation of the potential future transportation markets for ultra-clean liquid fuels products from GTL plants. The study would be based on the following:

- Data obtained for feedstock resource base, GTL plant construction and operation, modifications (for feedstock and product variations) and mobility costs; fuel types, quality, quantity, and manufacturing costs; and commercial usefulness of the resultant fuels
- Data for the production, type, and location of feedstocks, using various feedstock types for the analysis
- Data obtained from the fleet and dynamometer tests

3.4 COMPARISON OF ALTERNATIVES

A comparison of the effects of the No Action Alternative and the proposed action, for supporting development of the GTL project, is provided in Table 3-3.

Table 3-3. Comparison of the Effects of Alternatives

RESOURCE	NO ACTION	PROPOSED ACTION
Threatened & Endangered Species	No effect.	No effect. No threatened or endangered species, or special habitat areas, are located on or near the project site.
Wetlands	No effect.	No effect. No wetlands exist at the site proposed for the project.
Floodplains	No effect.	No effect. The site is not within either a 100-year or a 500-year floodplain.
Noise	Since the 10-acre site would remain available for lease, noise effects would depend on site use by the future industrial tenant.	Noise levels to local receptors would increase to either a maximum of 60 dB or 4 dBs above background.

RESOURCE	NO ACTION	PROPOSED ACTION
Water	Since the 10-acre site would remain available for lease, water effects would depend on site use by the future industrial tenant.	No surface or ground water would be used. Possible short-term effect due to stormwater contact with process materials. Potable water usage of about 10 gpm during the 6-month operating period.
Wastewater	Since the 10-acre site would remain available for lease, wastewater effects would depend on site use by the future industrial tenant.	Wastewater generation of about 6.7 gpm, treated for oil separation and pH adjustment prior to discharge to the City of Tulsa's POTW.
Geology & Soils	Since the 10-acre site would remain available for lease, geology and soil effects would depend on site use by the future industrial tenant.	Possible short term effect due to erosion during construction on the 10-acre site. A SWPPP for construction activities would be used to control and minimize erosion.
Infrastructure	Since the 10-acre site would remain available for lease, infrastructure effects would depend on site use by the future industrial tenant.	No new gas or electric transmission lines. Installation of paved access road to the 10-acre site; concrete foundations placed under gas and liquid processing and storage areas.
Traffic and Transportation	Since the 10-acre site would remain available for lease, traffic and transportation effects would depend on site use by the future industrial tenant.	Short term effect during construction and negligible increase in overall traffic. Reductions in SO_2, CO, hydrocarbons, particulates, and NO_x emissions for the 6 buses used at WMATA and Denali National Park.
Aesthetics and Visual Resources	Since the 10-acre site would remain available for lease, aesthetics and visual resource effects would depend on site use by the future industrial tenant.	Installation of processing equipment consistent in type with other tenants at the Industrial Park. Tank and exhaust stack vertical profiles would range from 20 ft to 50 ft.
Air	Since the 10-acre site would remain available for lease, air effects would depend on site use by the future industrial tenant.	Possible short term impacts during construction. Operation would result in PM_{10}, NO_x, CO, VOC, and SO_2 emissions at levels substantially below levels requiring designation as a major emission source. Process vent emissions destructed at 98% efficiency.
Solid Waste (Non-hazardous)	Since the 10-acre site would remain available for lease, solid waste effects would depend on site use by the future industrial tenant.	Solid waste volume of 8,640 cubic ft, or a daily average of about 8 cubic ft for the 3-year project.
Hazardous Waste	Since the 10-acre site would remain available for lease, hazardous waste effects would depend on site use by the future industrial tenant.	Small quantities of used catalysts, caustic material for water treating, and oil-water separator waste could be hazardous. Materials requiring disposal would be transported to an appropriate, permitted disposal location outside Oklahoma.

RESOURCE	NO ACTION	PROPOSED ACTION
Socioeconomics	Since the 10-acre site would remain available for lease, socioeconomic effects would depend on site use by the future industrial tenant.	Slight beneficial impact from additional 24 employees/jobs at the Port, about a 1% increase over the current level of 2,600 employees.
Historic and Cultural Resources	No effect.	No historic or cultural resources have been identified on or near the project site.
Native American Concerns	No effect.	No concerns identified.
Land Use	Since the 10-acre site would remain available for lease, land use effects would depend on site use by the future industrial tenant.	Development of an undeveloped 10-acre land parcel, currently vegetated with woodlands, grasses, and forbs, for industrial use. Development would be consistent with local planning commissions plans and policies.
Safety and Health	Since the 10-acre site would remain available for lease, safety and health effects would depend on site use by the future industrial tenant.	Occupational hazards would exist during facility construction and plant operation. Safety and Health measures established by OSHA would be implemented to protect workers and the public.
Environmental Justice	No effect.	No disproportionate adverse effects on low-income or minority populations.

4.0 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES OF THE PROPOSED ACTION

The primary purpose of an Environmental Assessment (EA) under NEPA is to identify the potential impacts of a major federal action on the environment. This section of the EA is organized to present the potential environmental consequences of the proposed action, which is DOE support for the proposed gas-to-liquids production and demonstration project.

4.1 PROJECT SUMMARY AND SITE LOCATION

The proposed project would comprise the construction of a small gas-to-liquids (GTL) plant to convert natural gas into ultra-clean fuels, primarily near-zero sulfur content diesel fuel, for performance testing in engines and fleet vehicles. The plant would be located on approximately 10 acres of land at the northwest corner of the Tulsa Port of Catoosa Industrial Park, approximately three miles north of Catoosa, Oklahoma. This site in the southeast quadrant of the northeast quarter of Section 6, Township 20 North, Range 14 East, in Rogers County, Oklahoma. Nominally, the plant would produce about 70 barrels per day of clean liquid fuels. Diesel fuel testing would be conducted in engines at existing locations used for automotive research and in bus fleets at the Washington (DC) Metropolitan Area Transit Authority and at Denali National Park.

The proposed plant would generate emissions of criteria pollutants (sulfur and nitrogen oxides, particulate matter, and carbon monoxide), non-methane hydrocarbons, and toxic air pollutants (ammonia, methanol, pentane, and hexane). Emissions totals would be below threshold values for major source classification. The plant would qualify for classification as a minor emission source subject to minor new source review and permitting by the Oklahoma Department of Environmental Quality (ODEQ). Process vapors would be collected and processed through a combustor, which would achieve 98% destruction efficiency.

Water consumption during the 6-month operating period would total 2.2 million gallons, with about 5% consumed as potable water and 95% used for process water. Produced water from the plant would be solids-free but could contain hydrocarbon constituents; this water would be collected and routed through a process water separator system for removal of hydrocarbons. Caustic treatment would also be applied as necessary for pH adjustment, before discharge to the City of Tulsa's water treatment plant.

Over the duration of the proposed project, approximately 434 million standard cubic feet of natural gas would be consumed to produce about 8,800 barrels of ultra-clean diesel fuel and 560 barrels of ultra-clean naphtha. The project would produce about 1.4 million gallons of wastewater and 8,640 cubic feet of non-hazardous solid waste.

The following sections describe the environmental setting of the project area and the potential consequences to the environment that would result from the proposed project.

4.2 GEOLOGY AND SOILS

4.2.1 Affected Environment

4.2.1.1 Site Soils

The major soil type at the proposed 10-acre project location is the Dennis-Bates complex typical of upland prairies, with two to five percent slope. The Soil Survey for Rogers County indicates that 50 percent of the acreage is Dennis silt loam, which consists of deep, dark-colored, well-drained soil that formed under tall prairie grasses in material that weathered from shale and sandstone. The depth of

underlying shale or sandstone ranges from 36 to 60 inches but averages about 50 inches. These soils are susceptible to water erosion unless proper grading and established vegetation exist. About 40 percent of this soil is Bates loam, which consists of deep dark-colored, well-drained soils in the uplands.

4.2.1.2 Site Geology

The proposed project site would be located in the Cherokee Platform geologic province, which occupies most of Osage, Tulsa, Rogers, Washington, Nowata, Craig, Wagoner, Muskogee, Okmulgee, Okfuskee, Creek, Lincoln, Payne, and Pawnee Counties in northeastern and central Oklahoma.

The oldest known rocks in Oklahoma are Precambrian granites and rhyolites; pre-existing rocks were altered, destroyed, or consumed by igneous or metamorphic activity. Heat and fluids given off by the Cambrian magmas changed an older group of sedimentary rocks into metamorphic rocks. Precambrian and Cambrian igneous rocks underlie all of the State and are the floor or "basement" upon which younger rock rest.

Shallow seas covered all of Oklahoma during various parts of the Cambrian, Ordovician, Silurian, and Devonian Periods. Thick limestone and dolomites were the most common rocks of these periods, although several formations of sandstone and shale also occurred. Deposition of sedimentary layers was quite uniform over vast areas of Oklahoma and parts of surrounding states, and thus individual rock formations can easily be recognized and are widespread throughout the southern Midcontinent region.

During the Mississippian and Pennsylvanian Periods, the sedimentary basins of Oklahoma sank much deeper and more rapidly than in earlier periods. Thick sequences of shale, with interbedded sandstone and limestone, were deposited in these basins and also in a deep basin that existed in the area of the present Ouachita Mountains. Most major outcrops in the eastern half of Oklahoma are rocks of Mississippian and Pennsylvanian age. Many of the major oil and gas fields in Oklahoma produce from Mississippian marine limestones and sandstones and from Pennsylvanian deltaic or marine sandstones. The proposed project site is underlain by rocks of the Pennsylvanian period, in a regional area characterized by gravel mining from deposits of loose shale.

Following the Pennsylvanian Period, a shallow sea covered western Oklahoma during the Permian Period. The mountains were substantially worn down, and rivers that flowed westward to the sea carried sand and mud that eroded from land in the eastern half of the State. The red color of these Permian sandstones and shales resulted from red iron-oxide compounds deposited with the sand and mud.

Non-marine shales and sandstones characterize the Triassic, Jurassic, and Cretaceous sedimentary rocks of Oklahoma. However, shallow seas covered southern and western Oklahoma during some of the Cretaceous Period, and this resulted in deposition of marine limestone and shale. The Triassic, Jurassic, and Cretaceous Periods comprise the Mesozoic Era, the so-called "Age of the Dinosaurs." Mesozoic rocks in Oklahoma have yielded a number of fine dinosaur fossils; however, these rocks are not characteristic of the proposed project site.

Since the broad, gentle rising of Oklahoma and surrounding areas above sea level at the beginning of the Tertiary Period, no part of the State has been covered by seawater. Oklahoma’s land surface sloped downward to the east and southeast, and extensive deposits of Tertiary sand and gravel were washed in by large rivers flowing from the newly formed Rocky Mountains.

The Quaternary Period, embracing the Ice Ages up through the present, is characterized as a time of erosion. Rocks and loose sediment at the land surface were weathered to soil, and the soil particles were carried away to streams and rivers. Hills and mountain areas were worn down, and sediment was carried to the sea or temporarily deposited on the banks and in the bottoms of rivers and lakes.

4.2.1.3 Site Topographical Setting

The proposed GTL plant location is a gradually sloping, irregular tract of land located at the northwest boundary of the Tulsa Port of Catoosa Industrial Park. The area is situated on the broad historical floodplain of Bird Creek and the Verdigris River, below a steep, moderately dissected ridge system to the west. The confluence of Bird Creek and the Verdigris River is approximately two miles southeast of the site. Bird Creek, which trends within 1.5 miles of the area to the southwest, and the Verdigris River represent the closest permanent water sources to the proposed project location. The proposed site is not located in either the 100-year or 500-year flood plains.

The proposed site slopes from an elevation of approximately 625 feet above mean sea level (amsl) on the northwest property boundary to 595 feet amsl at the southeast property boundary. No notable landforms are located within the proposed project boundaries.

4.2.2 Environmental Consequences

The land area to be altered by construction of the proposed GTL plant would include most of the 10-acre site. Erosion control during construction would be necessary due to the size of the project and soils to be disturbed. Erosion control measures would be constructed or placed in accordance with an approved Stormwater Pollution Prevention Plan for Construction Activities.

The proposed plant would not affect geology, soils, or topography. Topography within the area is generally flat to rolling and would be maintained after construction. Subsurface geology would not be affected. The greatest degree of impact from the proposed project would be to soils and would occur during construction. Following construction and during operation, the proposed project site would be covered by concrete in material storage and reactor areas, therefore minimizing the potential impacts from spills, traffic, or other activities.

4.3 SITE INFRASTRUCTURE

4.3.1 Affected Environment

The proposed plant site is bordered on the west and northwest by State Highway 266, a two-lane highway that connects the cities of Catoosa and Claremore. Located along the west and northwest property lines is a raw water main that supplies the City of Tulsa from Lake Eucha, in northeastern Oklahoma. A 16-inch natural gas supply pipeline serves the Port. The high-pressure gas line is located along the highway and the west/northwest property line. A railroad line borders the property to the east and southeast. The Tulsa Port of Catoosa operates this rail line and two locomotives to provide rail connections to major carriers. Dual-feed electric service is available at the Port, to serve the needs of each leased site. A high-voltage overhead electrical line runs along the east and southeast property line.

Water supply and wastewater services are available from the City of Tulsa. A service road along the City of Tulsa raw water line currently provides access to the site. This service road connects to an asphalt-paved road near the north entrance to the Port, approximately one-quarter mile east of the proposed plant location.

4.3.2 Environmental Consequences

The existing service road along the raw water line would be paved to provide permanent site access. Traffic to and from the plant would proceed by this planned road improvement. The site would employ 24 persons scheduled over three shifts. Employees would use existing roads within the Port prior to the

access road. No other transportation improvements, such as road expansions, turn lanes or traffic signals, would be required for the plant. Increases to traffic by the 24 employees would have negligible affect on the existing infrastructure at the Port, which serves 2,600 existing employees.

Construction of the proposed plant would require on-site transportation of hydrogen and nitrogen gas as well as water treatment chemicals and caustic. Additional materials for the proposed plant would consist of natural gas, which would be obtained from an existing, nearby pipeline, and water, which would be available at the site from the City of Tulsa's existing potable water pipeline. The indicated materials would be consumed in the process, disposed through process wastewater, or eliminated through a flare.

Products to be transported off-site would consist of synthetic fuels, both diesel and naphtha, as well as waste materials, including trash. The proposed project would produce (nominally) 70 barrels per day (bpd), or about 2,940 gallons per day (gpd), of synthetic fuels. Solid waste materials would be transported from the site using existing, licensed waste haulers, possibly transporters that provide service for comparable industrial tenants at the Port. Off-site transportation of synthetic fuels would be accomplished using approved containers. Transportation of the final product and project wastes would be performed in accordance with all applicable state and Federal regulations and requirements.

No new rail connections would be required for the proposed project. Neither new gas or water pipelines nor electrical transmission lines would be required.

4.4 AESTHETICS AND VISUAL RESOURCES

4.4.1 Affected Environment

Visual resources at the proposed plant site are defined by the surrounding industrial landscape to the northeast, east and southeast, a highway to the west, and a steep ridge to the west, which essentially blocks all other views. The visual characteristics of vegetation within the proposed project area can be described as woodlands with forbs and grasses along the perimeter clearings.

The existing landscape within the proposed plant area has moderate visual quality based on vividness, intactness, and unity attributes. The landscape components have no unique characteristics that convey visual excellence or rare contributions to scenic value in the State of Oklahoma or the region.

4.4.2 Environmental Consequences

Visual resources at the site are substantially defined by the existing, industrial landscape and transportation infrastructure. Lighting for facilities at the proposed plant site would not be an issue due to lighting use by the nearby industrial facilities.

Vegetation, including trees, would be cleared from the site. However, trees located on the public side of the site would be maintained to the maximum extent possible. Industrial development of the site for installation of the GTL plant would result in the installation of gas processing equipment, synthetic oil treatment equipment, and storage facilities for process feed materials and products. Storage tanks ranging in size up to 25-ft diameter and 19-ft height, steel structures for containing process units, exhaust stacks ranging in height from 20 ft to 50 ft, and other process structures and employee areas would be installed. These types of structures would be consistent in type with facilities installed by other industrial tenants at the Industrial Park, such as those existing facilities for agricultural product and petroleum product storage, gas purification, manufacture of specialty chemicals, and metal fabrication for drilling rigs and process equipment.

4.5 AIR RESOURCES

Air resources refer to the existing climatic and meteorological conditions and concentrations of various pollutants that influence air quality.

4.5.1 Affected Environment

4.5.1.1 Climatic and Meteorological Conditions

At a latitude 36 degrees north, Tulsa, Oklahoma, is sufficiently north to escape long periods of heat in summer, yet far enough south to miss the extreme cold of winter. The influence of warm moist air from the Gulf of Mexico is often noted, due to the high humidity, but the climate is essentially continental, characterized by rapid changes in temperature. Generally, the winter months are mild. Temperatures occasionally fall below freezing but only for a very short time. Temperatures of 100°F or higher are often experienced from late July to early September but are usually accompanied by low relative humidity and a southerly breeze. The fall season is long with a great number of pleasant, sunny days and cool nights.

The average annual rainfall is 37 inches, including about 8 inches of snow. Precipitation is ample for most agricultural pursuits and is distributed favorably throughout the year. Spring is the wettest season, providing an abundance of rain in the form of showers and thunderstorms. The steady rains of fall are a contrast to the rain showers of spring and summer and provide a good supply of moisture and more ideal conditions for the growth of winter grains and pastures. The greatest amounts of snow are received in January and early March. Snow is usually light and only remains on the ground for brief periods of time.

The date of the last 32°F temperature typically occurs in late March, and the date of the first 32°F occurrence is normally in early November. The average growing season is 216 days.

The Tulsa area is occasionally subjected to large hail and violent windstorms that occur mostly during the spring and early summer, although occurrences have been noted throughout the year. Prevailing surface winds are southerly during most of the year. Heavy fogs are infrequent and sunshine is abundant.

4.5.1.2 Air Quality

The National Ambient Air Quality Standards (NAAQS) established by the U.S. Environmental Protection Agency (EPA), and Oklahoma Ambient Air Quality Standards, define the allowable concentration of criteria pollutants that may be reached but not exceeded in a given time period. These air quality standards were established to protect human health (primary standard) and welfare (secondary standard) with a reasonable margin of safety. The criteria pollutant standards include maximum concentrations for ozone (O_3), carbon monoxide (CO), nitrogen oxides (NO_x), sulfur dioxide (SO_2), lead, and particulate matter with a diameter of 10 microns or less (PM_{10}).

Ozone is formed in the atmosphere by the photooxidation of reactive hydrocarbons in the presence of nitrogen oxides. Emissions of volatile organic compounds (VOCs) that participate in atmospheric photochemical reactions also result in ozone formation.

All counties in Oklahoma are in attainment status and comply with the NAAQS. The quantity of each criteria pollutant emitted by the proposed plant would be less than 100 tons per year (tpy), and less than 10 tpy of any one Hazardous Air Pollutant (HAP), or 25 tpy of total HAPs, would be emitted. Since these emission rates are the thresholds requiring designation of a facility as a major emission source, Syntroleum Corporation submitted a minor source air construction permit application to the Oklahoma Department of Environmental Quality (ODEQ) on April 9, 2001. Construction permit 2001-006-C was issued by ODEQ on July 2, 2001.

4.5.2 Environmental Consequences

The proposed plant was permitted by ODEQ as a minor source facility and would be operated in compliance with all state and Federal air regulations. A process vapor combustor would control process vent (i.e., VOC) emissions at a destruction efficiency rate of 98%. The proposed plant would not present potential for adverse impacts on air quality, except for potential short-term impacts at the site during plant construction.

The proposed plant would contain six combustion sources, as shown in Table 4-1.

Table 4-1. GTL Plant Combustion Sources

NO.	SOURCE	HEAT INPUT (MM BTU/HR)	EXHAUST STACK	
			HEIGHT, FT	DIAMETER, FT
1	Air Heater	1.11	25	1.06
2	Gas Heater	0.05	25	0.9
3	Gas Heater	1.62	30	1.16
4	Startup Boiler	5.0	30	1.16
5	Gas Turbine	20.96	20	2.0
6	Vapor Combustor	26.24	50	8.0

In accordance with the approved Permit to Construct (No. 2001-006-C) issued by the ODEQ, the facility heaters, boilers, and turbine would be fueled with only commercial natural gas. Records of natural gas consumption by all combustion sources would be maintained on a monthly and cumulative 12-month, rolling basis.

Emission estimates for criteria pollutants from the boiler and heaters were determined from EPA's compilation of air emission factors (AP-42) – Table 1.4-1, Emission Factors for Nitrogen Oxides and Carbon Monoxide from Natural Gas Combustion, and Table 1.4-2, Emission Factors for Criteria Pollutants and Greenhouse Gases from Natural Gas Combustion – based on a heating value for natural gas of 1,000 Btu per standard cubic feet (SCF).

Emission estimates for criteria pollutant discharges from the gas turbine were determined using AP-42 – Table 3.1-1, Emission Factors for Nitrogen Oxides and Carbon Monoxide from Stationary Gas Turbines, and Table 3.1-2a, Emission Factors for Criteria Pollutants and Greenhouse Gases from Stationary Gas Turbines. Emission estimates for vapor combustion were determined using AP-42 – Table 13.5-1, Emission Factors for Flare Operations. Table 4-2 presents the emission factors used to calculate pollutant discharges from the combustion sources.

Table 4-2. Emission Factors used for Plant Combustion Sources

COMBUSTION SOURCE	EMISSION FACTOR (LB PER MM SCF)					
	PM_{10}	SO_2	NO_x	CO	VOC	CO_2
Boiler and Heaters	7.6	0.6	100	84	5.5	120,000
Gas Turbine	6.6	0.6	320	82	2.1	110,000
Vapor Combustor	0	-	68	370	140*	**

* Total Hydrocarbons. To determine VOC emissions, methane content (55%) would be excluded, since methane is exempt from regulation as VOC due to its very low photochemical reactivity. Reactive hydrocarbons would thus constitute 45% of these emissions, or an emission factor of 63 LB per MM SCF.

** No value provided.

The emission rate for sulfur dioxide would be low, since the commercial natural gas mandated for use as fuel contains very low concentrations of sulfur. Typically, the content of sulfur in pipeline quality natural gas is 2,000 grains per MM SCF, or 0.285 lb sulfur per MM SCF. Assuming 100% combustion, the sulfur dioxide emission rate for natural gas combustion would be about 0.6 lb per MM SCF.

The vapor combustor would be equipped with a steam injector or an alternate mixing system (e.g., forced air or water spray) to ensure sufficiently high combustion efficiency for avoiding smoke formation.

Combining the emission factor information from Table 4-2 with the fuel consumption rates specified for the combustion sources in Table 4-1, the projected emission rates for criteria pollutants from combustion sources in the proposed plant are shown in Table 4-3. These emission rates would be incorporated into the permit for the plant.

Table 4-3. Emission Rates from Combustion Sources

NO.	SOURCE	PM_{10}		NO_x		CO		SO_2		VOC	
		LB/HR	TPY	LB/HR	TPY	LB/HR	TPY	LB/HR	TPY	LB/HR	TPY
1	Air Heater	0.01	0.04	0.11	0.49	0.09	0.41	<0.01	<0.01	0.01	0.03
2	Gas Heater	<0.01	<0.01	<0.01	0.02	<0.01	0.02	<0.01	<0.01	<0.01	<0.01
3	Gas Heater	0.01	0.05	0.16	0.71	0.14	0.60	<0.01	<0.01	0.01	0.04
4	Startup Boiler	0.04	0.17	0.50	2.19	0.42	1.84	<0.01	0.01	0.03	0.12
5	Gas Turbine	0.16	0.69	7.60	33.29	1.95	8.53	0.01	0.02	0.05	0.22
6	Vapor Combustor	0	0	1.78	7.82	9.71	42.52	0	0	1.65	7.24
TOTAL		0.22	0.95	8.48	44.52	12.3	53.91	0.01	0.04	1.75	7.65

The gas turbine (combustion source 5) would be subject to EPA standards for new combustion sources. Performance testing of the gas turbine would be required within 60 days following achievement of maximum production rate for the gas-to-liquids plant, but not later than 180 days following initial startup.

Using the carbon dioxide (CO_2) emission factors from Table 4-2 for the heaters, boiler, and turbine, the CO_2 emission rate would be about 4,100 tpy from the heaters and boiler and 10,100 tpy from the turbine. If all gas combusted in the vapor combustor resulted in a CO_2 emission rate comparable to that from the heaters and boiler, the CO_2 emission rate from the vapor combustor would be 13,800 tpy. At this rate, the total CO_2 emissions from all combustion sources would be 28,000 tpy.

While not regulated as an atmospheric pollutant, carbon dioxide is a greenhouse gas. The current and historical effects of CO_2 levels in the atmosphere remain a topic of scientific debate, but consensus exists that large increases (i.e., doubling) of atmospheric CO_2 concentrations from the current level of about 365 ppm would create a variety of serious environmental consequences, including increases in global average temperatures, with resulting changes in weather patterns, accelerated rise in sea level, etc.

Currently, global emissions of CO_2 exceed 7.5 billion tons per year. The projected CO_2 emissions from the GTL plant's combustion sources would be less than 0.00037% of present global emissions.

Fugitive emissions of VOCs would be expected from storage tanks and from leaks in hardware components (e.g., valves, seals, flanges, etc.) used in the gas processing plant. Estimates of VOC emissions from the storage tanks were determined using information from Section 7.1 (Organic Liquid Storage Tanks) of EPA's Compilation of Air Pollutant Emission Factors, AP-42. The emission levels

were developed using TANKS software, which is a computer program used commercially to estimate VOC and hazardous air pollutant emissions from storage tanks. This software is commonly used by Federal, state, and local agencies and others to calculate air pollutant emissions from organic liquid storage tanks.

The projected VOC emissions rates for the eleven storage tanks are presented in Table 4-4. Since the vapor pressure (i.e., measure of the tendency of a liquid or solid to form gaseous molecules) of naphtha (11.04 psia) is substantially greater than the vapor pressure of diesel fuel (0.04 psia), the VOC emissions from naphtha storage tanks would be much greater than those from the diesel tanks. To minimize formation of hydrocarbon vapors, and for compliance with regulations covering storage tanks, each naphtha tank (Numbers 1,2, 5, 6, and 7) would be filled from the bottom.

Table 4-4. Emissions of VOCs from Storage Tanks

TANK NO.	CONTENTS	CAPACITY (GALLONS)	OPERATING LIMIT (BARRELS/YEAR)	VOC EMISSIONS	
				LB/HR	TPY
1	Naphtha	2,520	1,323	0.17	0.75
2	Naphtha	2,520	1,323	0.17	0.75
3	Diesel	10,080	23,519	<0.01	0.01
4	Diesel	10,080	23,519	<0.01	0.01
5	Naphtha	18,900	1,323	0.41	1.80
6	Naphtha	18,900	1,323	0.41	1.80
7	Naphtha	18,900	746	0.38	1.65
8	Re-Run	21,000	4,477	<0.01	0.02
9	C10+	21,000	50,753	0.02	0.07
10	Diesel	69,300	23,519	0.01	0.04
11	Diesel	69,300	23,519	0.01	0.04
Total VOC Emission Rate from Facility Storage Tanks				1.58	6.94

Within the GTL plant, additional sources of fugitive VOC emissions would result from leaks in process equipment, specifically pipe connections, pipe flanges, pump seals, control valves, and compressors. Approximately 2,800 of these potential sources of fugitive emissions would be included in the proposed facility. Using emission factors developed by EPA (EPA-453/R-95-017), and based on the anticipated service of these items of equipment, the organic carbon emissions from these equipment items would total 10.99 lb/hr, or 48.15 tpy. These values were used by ODEQ to establish the maximum permitted VOC emission level for process equipment.

Combining the emissions from combustion sources, storage tanks, and process equipment, Table 4-5 presents the total annual emissions of air pollutants that would be anticipated from operation of the proposed plant.

Table 4-5. Total Annual Emissions from the Gas-to-Liquids Plant (Tons)

SOURCE	PM_{10}	NO_x	CO	SO_2	VOC
Boiler and Heaters	0.26	3.41	2,87	0.01	0.19
Gas Turbine	0.69	33.29	8.53	0.02	0.22
Vapor Combustor	0	7.82	42.52	0	7.24
Storage Tanks	0	0	0	0	6.94
Fugitive Emissions	0	0	0	0	48.15
TOTAL	0.95	44.52	53.92	0.03	62.74

Since the annual emission rate of each criteria pollutant from plant operation would be less than the threshold level of 100 tpy, as specified in Federal and state regulations for designation as a major emission source, the proposed facility would comply with conditions appropriate for classification as a minor source of emissions, which precludes need for emissions modeling or application of Best Available Control Technology.

Gases that would be collected for processing in the vapor combustor may contain small quantities of ammonia, methanol, pentane, and hexane, which are (low toxicity) toxic air contaminants under Oklahoma law (OAC 252:100-41). EPA also regulates methanol and hexane as Hazardous Air Pollutants. Conservatively, destruction efficiency for organic vapors in the combustor would be at least 98%. The quantity of each of these materials that would be produced in the GTL plant, and thus the level of emissions of toxic air contaminants, would be proportional to the anticipated maximum processing rate for natural gas, which would be about 5,325 lb per hour. Projected emission rates for these toxic air pollutants are shown in Table 4-6.

Table 4-6. Projected Emission Rates of Toxic Air Pollutants from the Proposed Plant

POLLUTANT	AMOUNT PRODUCED	EMISSION RATE (FOLLOWING VAPOR COMBUSTOR)	
	LB/HR	LB/HR	TPY
Ammonia	3.10	0.06	0.27
Methanol	3.06	0.06	0.27
Pentane	35.1	0.70	3.08
Hexane	29.4	0.59	2.57

None of the toxic air pollutants would exceed the *de minimus* threshold level of 6 tpy, or a maximum of 5.6 lb/hr, for regulation under Oklahoma law.

The proposed plant would be in compliance with National Emissions Standards for Hazardous Air Pollutants (NESHAPs). New Source Performance Standards (NSPS), as defined at 40 CFR 60, Subpart Kb, require record keeping pertaining to certain tanks. The proposed facility would comply with the record keeping requirements of Subpart Kb.

4.6 WATER RESOURCES AND WATER QUALITY

4.6.1 Affected Environment

Surface water resources in the area of the proposed plant include the Verdigris River, located approximately 2 miles southeast, and Bird Creek, located approximately 1.5-miles southwest. No surface water impoundments are located on the proposed site. Groundwater resources in the area consist of alluvium and terrace deposits along the Verdigris River. This aquifer is generally unconfined with a saturated thickness of 25 to 70 feet. Water from the aquifer tends to be very hard with dissolved solids concentrations ranging up to 500 milligrams per liter (mg/l).

The Oklahoma Department of Environmental Quality (ODEQ) is authorized by the U.S. Environmental Protection Agency to administer the National Pollutant Discharge Elimination System in Oklahoma. ODEQ regulations require permits for construction activities that disturb more than 5 total acres and include requirements for installation of water or sewer lines. A permit to discharge stormwater from a construction activity must be obtained prior to initiation of any soil disturbance. In addition, a Stormwater Pollution Prevention Plan (SWPPP) for the construction site must be developed. The SWPPP must contain information describing the site, stormwater controls, maintenance, inspections, and non-stormwater discharges.

4.6.2 Environmental Consequences

The proposed plant would not use surface or groundwater sources for domestic, process, or fire water. Potable water for domestic and process operations would be obtained from the City of Tulsa potable water system. Fire water supply would also be obtained from this system. Potable water use by the facility, not including fire flows, would be approximately 10 gallons per minute (gpm) for process operations and domestic water use. Total water usage during the lifetime of the DOE project would be approximately 52,594 barrels (about 2.2 million gallons), with about 5% used for potable water and 95% used for process water. Construction of additional or upgraded mains to supply this volume of water would not be required.

Process water would be collected by a closed-drain system. Water potentially contaminated by hydrocarbons would be processed through a water separator to remove the hydrocarbon species. Process water with a pH below established discharge limits would be processed for pH adjustment in a caustic injection vessel. All process water streams would be combined and tested to ensure compliance with permit requirements prior to discharge.

Wastewater would be discharged to the City of Tulsa sanitary sewer system under a permit for industrial wastewater discharge. Wastewater would be treated in Tulsa's publicly owned treatment works (POTW) prior to final discharge in accordance with the POTW's Oklahoma Pollutant Discharge Elimination System permit. Domestic wastewater would also be disposed using the City of Tulsa POTW. Process and domestic wastewater discharges from operation of the proposed plant to the POTW would be about 6.7 gpm. Over the time duration of the DOE project, a total of about 33,520 barrels (1.4 million gallons) of wastewater would be produced.

During plant construction, stormwater would be managed in accordance with an ODEQ-approved General Construction Permit for Stormwater. A Stormwater Pollution Prevention Plan for Construction activities would be developed and implemented.

A final plan for management of stormwater during GTL plant operation at the proposed site has not been fully defined. Final design of a stormwater management plan would be completed in consultation with the City of Tulsa. A critical factor to be considered in developing the plan is a requirement that, if stormwater contacts process-derived, spilled, or leaked materials (e.g., produced diesel fuel), the water would be prohibited from discharge as stormwater; this water would require treatment and disposal in accordance with wastewater regulations.

During operation, although the plant would be exempt from permit requirements, an internal SWPPP would be implemented. This Plan would incorporate best management practices for stormwater management during plant operation.

Stormwater can be segregated into two categories: runoff that has contacted process areas, and thus has a potential for contamination, or runoff that has not contacted process areas or raw materials. Under current plans, stormwater that does not contact process materials (non-process or non-contaminated stormwater) would be planned for discharge to an unnamed tributary of Bird Creek. This stormwater would flow by natural drainage pathways.

Stormwater that might become contaminated at levels exceeding regulations would be controlled, treated prior to discharge from the site, discharged under a permit with the ODEQ, and monitored. Contaminated runoff could be diverted to the plant's wastewater stream, treated, and undergo disposal into the city sewer as Class II water. Class II water is Oklahoma's classification for water "containing or suspected to contain pollutants for which the toxicity, concentration and volume pose a moderate risk of harm to humans, aquatic life, wildlife, or the environment, either through the potential to migrate in groundwater

or a reasonable possibility, if discharged, to degrade the beneficial uses of the receiving water as designated in the Oklahoma Water Quality Standards." The discharge limit into the City of Tulsa's sewer system at the Tulsa Port of Catoosa is 100 mg/l for phase-separated oil and grease and 500 mg/l for dissolved-phase oil and grease.

The proposed plant would not include work that would affect navigable waters of the United States. In addition, the proposed plant would not require discharge or deposit of dredge or fill material into waters of the United States. No Clean Water Act Section 404 or 402 permit would be anticipated for site actions. No requirement for a Section 10 permit under the River and Harbors Act would be anticipated.

4.7 SOLID AND HAZARDOUS WASTE

4.7.1 Affected Environment

The proposed site consists of an undeveloped 10-acrea parcel of land with no current human activity.

4.7.2 Environmental Consequences

Over the 36-month duration of the DOE project, an estimated 8,640 cubic ft of non-hazardous waste would be generated. The average quantity of waste generation per month would be less than 9 cubic yards. Commercial haulers would be used to transport this non-hazardous waste to a public landfill that has been permitted by the City of Tulsa Public Works Department. If, during the course of this project, the monthly quantity of non-hazardous solid waste requiring disposal should exceed 10 cubic yards, the facility operator would prepare and maintain a tracking document for each load of solid waste transported for disposal.

Potentially hazardous wastes would be generated from facility operations. These wastes could include spent catalysts from hydroprocessing, sludges from the oil-water separator, and caustic material used for water treatment. These wastes would be appropriate categorized or characterized for hazard potential. Wastes determined to be hazardous would be temporarily stored at the site in advance of transport for disposal. Disposal of hazardous wastes would be accomplished using a properly licensed hazardous waste hauler for transport to an appropriate disposal site outside the State of Oklahoma.

4.8 NOISE

Sounds that disrupt normal activities or otherwise diminish the quality of the environment are designated as noise. Noise can be stationary or transient, intermittent or continuous. Community response to noise is based on a subjective assessment of the daily noise environment. Factors included in this assessment of noise impacts are the noise levels of individual events, the duration of noise events, and the time of day at which the events occur.

4.8.1 Affected Environment

The proposed plant would be limited, by the land use rental contract with the Tulsa Port of Catoosa, to maximum operational noise levels at the property line of 4 decibels (dB) above background levels or 60 dB, whichever is greater. For reference, 60 dB is approximately the noise level created by two people speaking three feet apart. Noise events within the area proposed for the GTL plant are presently associated with climatic conditions (i.e., wind or thunder), transportation noise (i.e., traffic, highways, railroad lines, or air traffic), and localized activities (i.e., industrial activities at the Port). The insert on the following page presents information on typical levels of noise generated by familiar events, along with an identification of health concerns, if any, associated with those noise levels.

A noise survey was completed in August 2001 to assess background noise levels. In addition, a separate noise study was performed in March 2001 to assess potential property line noise levels during operation. The August 2001 survey was conducted on a hot (86°F), relatively calm (winds <10 mph), dry day using a Quest 2900 integrating/logging noise level meter. Recordings were taken at roughly the midpoints of the four sides of the property boundary, approximately four feet above ground. The time-weighted equivalent (L_{eq}) noise levels (an equivalent noise level calculated from recordings over a 24-hour day) on the property lines bordering the two adjacent Industrial Park properties were 50.8 dB(A) and 51.2 dB(A). The L_{eq} on the property line facing State Highway 266 was 53.6 dB(A), and the L_{eq} on the property line closest to the active railroad track (about 65 ft north of the track) was 58.6 dB(A).

Levels of Noise by Type of Event

Loudness of sound is measured in units of decibels (dB); loudness as heard by the human ear is measured on the A-weighted dB scale (dBA). An increase of one dB equals 30% more noise energy; an increase of 10 dB equates to a doubling of the noise energy. Sound levels decrease by about 6 dB for every doubling of distance from the sound source. A few examples comparing familiar noises and their exposure concerns are as follows:

Source*	DB	Concern
Soft Whisper	30	None. Normal safe levels.
Quiet Office	40	
Average Home	50	
Conversational Speech	66	
Busy Traffic	75	May affect hearing in some individuals, depending on sensitivity, exposure duration, etc.
Noisy Restaurant	80	
Average Factory	80-90	
Pneumatic Drill	100	Continued exposure to noise over 90 dB may eventually cause hearing impairment
Automobile Horn	120	
Jet Plane	140	Exposure to noise at or over 140 dB may cause pain
Gunshot	140	

* Noise and You, Channing Bete Co., Inc., South Deerfield, MA, 1985.

4.8.2 Environmental Consequences

During construction of the proposed plant, noise would be localized, intermittent, and temporary. Short-term impacts may be realized during construction, which would require a maximum time duration of 12 months. Individual construction activities during this time would be completed in substantially shorter times, but could result in noise levels approaching 100 dB at the source.

In March 2001, a noise simulation study was performed at the proposed site to assess the potential impacts of plant operation. Noise level recordings were made for operating equipment comparable to that proposed for use in the GTL plant: gas turbine (107 dB maximum), pumps (88 dB to 93 dB), fans (82 dB), compressor (85 dB), and fired heater (78 dB). The equipment sound recordings, with matching frequencies and decibel levels, were replayed at a location near the southeast corner of the proposed site. Noise measurements made during the replay indicated the following:

- No increase in noise was detected at the hill overlooking the Tulsa Port of Catoosa, to the west of the proposed site
- Near the property line on the north-west side of the proposed site, noise level increased by about 5 dB

- At a point about 300 ft east of the replay equipment, sound level increased from 55-57 dB to 64-66 dB

Reduction in simulated turbine noise from 107 dB to 80 dB resulted in about a 2 dB reduction in overall noise level around the proposed site. Simultaneous reduction in simulated noise levels from the pumps resulted in reduction of overall noise to a level acceptable to Tulsa Port of Catoosa management.

To minimize noise level at the property line, an enclosure or building would be used to house the gas turbine. Other noise generating equipment, such as pumps, compressors, and heaters, would be selected and purchased using a criterion that noise level must be 80 dB or lower at a distance of 4 ft from the equipment. To achieve a maximum noise level of 60 dB at the property line, equipment generating noise levels of 80 dB at 4 ft would require placement of the site at distances of 32 to 64 ft from the property line. If such equipment could not reasonably be located, the equipment would be located in a building or fitted with an enclosure to minimize noise levels.

The proposed plant would be designed to meet the lease requirements limiting property line noise levels to 60 decibels (dB) or 4 dB above background noise levels, whichever is greater.

4.9 LAND USE

4.9.1 Affected Environment

The proposed 10-acre site for the GTL plant is located within the 2,000-acre Tulsa Port of Catoosa Industrial Park. Parcels of land, typically ranging in size from 5 acres to 150 acres, within the Park are leased to industrial tenants. Land use provisions and restrictions for leased parcels are legal stipulations contained in lease agreements executed with the Tulsa Port of Catoosa by tenants of the Park. Sections 10 and 3.3.1.2 of this Environmental Assessment provide additional details on existing uses of land in the Industrial Park.

4.9.2 Environmental Consequences

The proposed plant would result in permanent changes to the existing conditions of the 10-acre, undeveloped project site. The woodlands, grasses, and forbs on the site would be substantially replaced by facilities required for the GTL production plant. Changes to the site would be governed by the lease executed with the Tulsa Port of Catoosa and with the reviews and approvals that would be required from the local planning commission prior to initiation of industrial activity. Section 10 provides additional information on reviews and approvals of land uses within the Industrial Park.

4.10 SOCIOECONOMIC SETTING

4.10.1 Affected Environment

The proposed plant location is approximately 3 miles from the central business district of Catoosa, which has a population of approximately 2,950. Catoosa's present expanded location adjoins both Tulsa and Wagoner counties, while the city is located in Rogers County. The city experienced a growth rate of 62.5 percent during the 1990s, making Catoosa one of the fastest growing cities in the region. The 2,000-acre Tulsa Port of Catoosa Industrial Park is situated at Catoosa's northern edge and has operated since 1971. The Industrial Park is currently home to 50 companies employing 2,600 people.

The proposed plant location is 12 miles from central Tulsa, which has a population of approximately 386,000. Tulsa's largest employers cover a multitude of industries, including manufacture of electronic

components, aircraft flight training equipment, major household appliances, steel products, aviation and aerospace products, ceramic tile, glass products, petroleum products, and outdoor sporting equipment. In addition, Tulsa's service workforce is engaged in general medical and surgical services, certified air transportation and fleet maintenance, credit card processing, wholesale grocery distribution, educational systems, telecommunications products and services, convenience stores, airline reservations, banking government, operation of satellite systems, military operations, insurance services, retailing of general merchandise, and newspaper publishing. Total unemployment for the Tulsa Metropolitan Statistical Area is around 3 percent. The service sector employs the greatest share of the workforce, with approximately 31 percent of the total.

Five rural homes and a sub-division containing 58 lots are located within a half-mile radius of the proposed plant site. Of the 58 subdivision lots, seven have initiated or completed construction, and five of the seven lots are occupied. The overall population density in the area is sparse and the estimated population within a half-mile radius is 30 persons.

4.10.2 Environmental Consequences

The proposed plant would have a small beneficial impact on socioeconomics through increases to area employment, with the transfer of 17 jobs and addition of 7 new jobs. Labor requirements for construction and operation of the proposed plant would be obtained from readily available workforce within the surrounding metropolitan areas.

4.11 WETLANDS

The U.S. Army Corps of Engineers (USACE) regulates impacts to jurisdictional "waters of the United States" under the authority of Section 404 of the Clean Water Act (33 USC Section 404 *et seq.*). Jurisdictional "waters of the United States" include all navigable waters, interstate waters, their tributaries, and adjacent wetlands. Within the plant area, no jurisdictional waters are found, including perennial or intermittent streams, ponds, and wetlands, considered as "other waters" under the Clean Water Act. For the purpose of this EA, the term "wetland" refers to those vegetated areas that are likely to be regulated as a special aquatic site under Section 404 of the Clean Water Act.

Features on National Wetlands Inventory (NWI) maps are classified according to a system developed by the U.S. Fish and Wildlife Service (USFWS). This system is referred to as the Cowardin System, after its principal author, and is used to establish the type of aquatic system being inventoried.

4.11.1 Affected Environment

Reviews of NWI maps from USFWS and a United States Department of Agriculture (USDA) Rogers County soil survey for evidence of wetlands indicated that the proposed plant site would not be located in any area that is depicted as a wetland.

The proposed plant site is densely wooded and currently can be classified as regrowth timber, 10-20 years of age. The site lies within the Oak-Hickory Association-Deciduous Forest Vegetational Region, generally characterized by tall grasses and mixed forbs, with areas of moderate to dense mixed hardwood forest.

The USDA soil survey for Rogers County indicated that the major soil at the proposed plant location is the Dennis-Bates complex (refer to Section 4.2.1.1). This soil is not classified by the USFWS as a hydric soil and does not support wetland environments. Soil conditions are not conducive to slow draining, and vegetative conditions or reducing conditions resulting from prolonged saturation are not normally present.

A field visit was conducted in August 2001 by URS Corporation, a contractor hired to provide environmental support, to evaluate the potential for occurrence of site ecological receptors in the area proposed for the GTL plant. No areas that exhibited wetland criteria (i.e., vegetation, hydric soil, and hydrology) were identified.

4.11.2 Environmental Consequences

For the purpose of this EA, the potential for existence of wetlands was evaluated using NWI maps and a site survey. Neither the field visit nor research of available information revealed wetlands, or indications of wetlands, on the plant site.

4.12 FLOODPLAINS

4.12.1 Affected Environment

The proposed site is generally situated on the broad floodplain of the Verdigris River, but the project site is not within either the 100-year or the 500-year floodplain.

4.12.2 Environmental Consequences

Activities associated with the proposed plant would not be expected to impact or be impacted by either a 100-year or a 500-year flood event.

4.13 BIOLOGICAL RESOURCES

4.13.1 Affected Environment

The proposed plant site is located in the Central Irregular Plains ecological region. The Central Irregular Plains are characterized by a mix of land use types and tends to be topographically irregular. The natural vegetation of this ecological region is a grassland/forest mosaic with wider forested strips along streams. The mix of land use activities in the Central Irregular Plains includes mining operations for high-sulfur bituminous coal.

On August 29, 2001, URS contacted the Tulsa office of the USFWS to identify any location or potential locations for endangered species in or near the plant site. The USFWS indicated that no crucial wildlife habitats, current Federal or state-listed threatened or endangered species, designated critical habitat, species in need of conservation, or public recreation areas are located within the plant site. A subsequent contact with the USFWS by DOE confirmed this conclusion. Section 11 and Appendix A of this Environmental Assessment provide additional details regarding the USFWS contacts.

The listed species of Rogers County, Oklahoma, along with a description of their habitat, are identified below.

4.13.1.1 Federal Threatened & Endangered Species

- Interior Least Tern – Interior least terns favor islands or sandbars along large rivers for nesting. The sand must be mostly clear of vegetation, and least terns prefer shallow water for fishing. Water levels must be low enough so that nests stay dry.
- Whooping Crane – Whooping cranes inhabit marshes and prairie potholes in the summer. In winter, they are found in coastal marshes and prairies.

- Bald Eagle – Bald eagles require large trees or cliffs near water with abundant fish for nesting. They winter along oceans, rivers, lakes, or in areas where carrion is present.
- Piping Plover – Piping plovers nest on sandy beaches bordering oceans or lakes. Along rivers, piping plovers use the bare areas of islands or sandbars for nesting. They also nest on the pebble mud of interior alkali lakes and ponds. During the winter, piping plovers use algae, mud, and sand flats along the Gulf Coast. Spoil islands in the Intracoastal Waterway are also used.
- Western Prairie Fringed Orchid – This prairie wildflower is known to occur in seven states and one Canadian province. The orchid occurs most often in remnant native prairies and meadows, but has also been observed at disturbed sites.
- Arkansas Darter – This small, colorful Arkansas darter lives in shallow, cool, clear spring-fed pools and creeks with sandy bottoms and abundant vegetation. They are intolerant of silty accumulations.
- Neosho Mucket – The Neosho mucket is a freshwater mussel that is endemic to the upper Arkansas River system in northeast Oklahoma and in neighboring areas of Kansas, Missouri, and Arkansas. The Neosho mucket helps stabilize river and stream bottoms, provides a food source for fish, turtles, muskrats, raccoons, otters, and other species, and feeds on algae and plankton, leaf litter, and other suspended particles, thus serving as a water filter.

4.13.1.2 State Threatened & Endangered Species

- Texas Horned Lizard (horn toad) – Texas horned lizards require dry, sandy areas with little vegetation.

URS personnel visited the proposed plant location on August 30, 2001. The purpose of the field visit was to evaluate the potential occurrence of site ecological receptors and critical habitat areas for species of concern in Rogers County, Oklahoma.

No Federal or state listed endangered species were observed in the plant area or the immediate vicinity. Suitable habitat required for the listed species was not observed. Animal species that were observed during the field visit included chickadees, tufted titmice, a downy woodpecker, turkey vultures, blue jays, a three-toed box turtle, and five-toed skinks.

4.13.2 Environmental Consequences

4.13.2.1 Wildlife

Impacts to wildlife from removal of site vegetation, project operation, and potential future demolition would include a temporary decrease in population of smaller, less mobile animals. Wildlife species that would be impacted are common to rural environments of Oklahoma, and the limited habitat destruction at the proposed site would not be expected to affect the viability of regional populations.

4.13.2.2 Vegetation

The majority of the area potentially affected by construction of the proposed plant would be woodlands that are 20 years old or less. Short-term damage or losses of vegetation in these areas would not affect the viability of regional populations.

4.13.2.3 Threatened and Endangered Species

None of the species listed in the Oklahoma Natural Heritage Inventory or County Lists of Federally Listed Species of Oklahoma for Rogers County were observed in the plant area or immediate vicinity.

Furthermore, consultation with the USFWS confirmed that no threatened or endangered species are located in the area. Construction of the proposed plant would not remove habitat that would support the threatened and endangered species listed for Rogers County, and thus construction would have no potential impact on the listed species. Copies of consultation correspondence with the USFWS are provided in Appendix A.

4.14 HISTORIC AND CULTURAL RESOURCES

4.14.1 Affected Environment

The Oklahoma Archeological Survey and Oklahoma Historical Society were contacted to identify properties of historic or cultural significance in the plant area. Copies of these contact letters are included in Appendix A. No historic or culturally significant properties were listed for the plant area.

Cojeen Archeological Services (Cojeen) of Norman, Oklahoma, performed a cultural resources survey of the proposed plant location in March 2001. Pedestrian transects at 50 ft spacing, augmented by shovel testing, were utilized as field methodology. No historic or prehistoric cultural resources were observed during the course of the survey, and archaeological clearance was recommended. The survey report also recommended that the State Archeologist and State Historical Preservation Office (SHPO) should be contacted and that construction activities should be halted if any subsurface archaeological materials should be observed during construction.

4.14.2 Environmental Consequences

Contacts with the Oklahoma Archeological Survey in 2001 and in January 2002 confirmed that no sites of archaeological significance are listed in the proposed plant area. An archaeological field inspection indicated that the proposed plant would not affect either archaeological or cultural resources. The Oklahoma SHPO indicated that the proposed plant would appear to have no impact upon any historic properties that would meet the criteria for listing on the National Register of Historic Places (NRHP). However, based on the topographic and hydrologic setting, archaeological materials could potentially be encountered during excavations. Section 11 and Appendix A of this Environmental Assessment provide additional information regarding those contacts.

Construction of the proposed plant would result in clearing and grubbing of the site and excavation of surface soils. As a result, archaeological resources could be encountered. In the event that archaeological resources should be encountered during construction, excavation activities would cease until the significance of the resources has been determined, and appropriate mitigation measures, as identified by the State Archeologist and SHPO, would be implemented.

4.15 NATIVE AMERICAN CONCERNS

The proposed plant site is not located on tribal lands and does not adjoin tribal lands. The Cherokee Nation was consulted regarding development of the site. A proposed SWPPP for construction activities was prepared and submitted to the Cherokee Nation in Tahlequah, Oklahoma, for review. The Cherokee Nation had no objection to the SWPPP or plans to develop the site. Correspondence from the Cherokee Nation, as provided in Appendix A of this Environmental Assessment, documents this position. The Cherokee Nation did not indicate the presence of Native American Concerns at the proposed plant location. Finally, the Cherokee Nation urged that all applicable rules, regulations, and best management practices be followed.

The Oklahoma Archeological Survey indicated the potential for archaeological material to be encountered during excavations. These archaeological materials could include evidence of Native American

habitation. Appropriate controls would be established during site development to determine the significance of any uncovered cultural resources, and the approach to project implementation that was emphasized by the Cherokee Nation would be applied.

4.16 TRAFFIC AND TRANSPORTATION

4.16.1 Affected Environment

4.16.1.1 Tulsa Port of Catoosa Site

A service road along the City of Tulsa's raw water line currently provides access to the site. This service road connects to an asphalt-paved road near the north entrance to the Port, approximately one-quarter mile east of the proposed plant's location. Approximately 2,600 employees access the Port on a daily basis.

4.16.1.2 Bus Fleet Tests at WMATA and Denali National Park Sites

The proposed project would provide for fleet vehicle tests using three buses in each of the fleets operated by WMATA and at Denali National Park. Currently, these buses operate using diesel fuel with the following EPA-mandated specifications:

- Sulfur content of 500 parts per million (ppm) or less
- Cetane index at least 40
- Aromatics content of 35% (maximum) by volume

New EPA standards for diesel fuel will become effective starting June 1, 2006, for any motor vehicle diesel fuel that is produced or imported. A phase-in period between 2007 and 2010 is provided in the regulations for engine manufacturers. The new regulations will impose requirements for a reduction in sulfur content of diesel for heavy duty trucks and buses to a level of 15 ppm or less.

4.16.2 Environmental Consequences

4.16.2.1 Tulsa Port of Catoosa

The existing service road would be paved to provide permanent site access. Traffic to and from the plant would proceed by this planned road improvement. The GTL plant would employ 24 persons scheduled over three shifts. Employees would use existing roads within the Port prior to the access road. No other transportation improvements, such as road expansions, turn lanes or traffic signals, would be required by the project. The incremental addition of vehicle traffic to serve the needs of the proposed plant would not be expected to be noticeable.

Construction of the proposed GTL plant would require movement or on-site transportation of construction materials, equipment, and construction workers. Transportation needs for plant construction would be intermittent and relatively short duration, due to the anticipated 12-month construction schedule. Operation of the proposed plant would require on-site transportation of hydrogen and nitrogen gas as well as water treatment chemicals and caustic. Additional raw materials for the proposed plant would consist of natural gas, which would be obtained from an existing, nearby pipeline, and water, which would be obtained from existing City of Tulsa water lines.

Products to be transported from the plant site would consist of synthetic fuels, both diesel and naphtha, as well as waste materials, including trash. The proposed plant would produce (nominally) 70 barrels per

day (bpd), or 2,940 gallons per day (gpd), of ultra-clean synthetic fuels. Waste materials would be transported from the site using existing, licensed transporters; current operations by other tenants at the Tulsa Port of Catoosa would be expected to require use of transporters for similar waste materials. Transportation of synthetic fuels would be accomplished using standard, approved containers. Transportation of the final product and project wastes would be performed in accordance with all applicable state and Federal regulations and requirements.

4.16.2.2 Bus Fleet Tests at WMATA and Denali National Park

The proposed project would result in testing ultra-clean diesel fuel in 6 buses from the fleets operated by WMATA and at Denali National Park. This diesel fuel would contain the following specifications:

- Sulfur content less than 1 ppm
- Cetane index at least 70
- Aromatics content essentially zero

Tests have been conducted using ultra-clean, GTL diesel in an unmodified light-duty diesel engine. In addition to essentially eliminating emissions of sulfur oxides, the tests demonstrated emission reductions of 46% for carbon monoxide, 38% for hydrocarbons, 30% for particulates, and 8.3% for nitrogen oxides.

4.17 SAFETY AND HEALTH

4.17.1 Affected Environment

No industrial or commercial activities currently occur on the 10-acre parcel of land proposed for the GTL plant. The Tulsa Port of Catoosa provides site security for tenants at the Industrial Park. Entrance roads to the Park are gated with controlled access and after-hours security.

4.17.2 Environmental Consequences

Safety and health for workers involved in construction and operation of the proposed GTL plant would be substantially governed by compliance with regulations established pursuant to the Occupational Safety and Health Act.

Some materials to be used and produced during operation of the proposed plant would possess hazard characteristics. The ultra-clean diesel fuel to be produced by the facility would be characterized as a hazardous material due to its volatility (i.e., flash point below 140^{O}F). Naphtha produced by the facility would be characterized as a hazardous material for the same reason. These fuel products would be retained and used in engine and fleet vehicle tests. Small quantities that would remain from activities such as analytical testing would eventually undergo disposal in accordance with applicable waste disposal regulations. Fuel products would be stored in tanks or approved containers with appropriate containment for accidental releases. In addition, a Spill Prevention, Control, and Countermeasures Plan would be developed and applied for protection against adverse impacts from spills of chemical materials.

Hydrogen gas that would be consumed in the GTL plant would be purchased, delivered, and stored in high-pressure tube trailers. Tube trailer supplies of hydrogen provide a common method for industrial users to procure and store hydrogen for use.

Caustic that would be used for water treating would possess health hazards. Supplies would be stored in approved containers, but hazard potential would exist during caustic material handling. Safeguards (e.g., eye protection, etc.) would be used to ensure worker safety.

For the GTL plant, since operations would involve handling and processing of combustible gases (natural gas and hydrogen), safeguard protections against flames and other spark ignition sources would be established. Process operations would substantially be open to the atmosphere, thus minimizing potential for gas build-up in stagnant or confined areas.

Plant workers would be required to use hearing protection in areas with noise levels exceeding 87 dB. An employee protection program including regulatory training and both equipment and operations training would be established to protect plant workers. Personal protective equipment for employee use would include safety glasses, hard hats, fire retardant clothing, and hearing protection.

In the event of an accident, the Tulsa Port of Catoosa maintains a full service occupational health clinic, complete with helipad and staffed by an affiliate of St. John Hospital.

4.18 POLLUTION PREVENTION

Materials usage would be minimized, to provide only for the essential needs of the GTL plant. During plant construction, topsoil would be stockpiled and used for final landscaping and contouring. During operation, stormwater would be managed to minimize runoff that could potentially become contaminated in process areas, and stormwater that does contact potentially contaminated process areas would be collected and appropriately treated for oil separation and pH adjustment prior to discharge. To the extent possible, used catalysts would be transported for recycle or recovery of reusable materials.

4.19 ENVIRONMENTAL JUSTICE

Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, requires that Federal Agencies identify and address any disproportionately high and adverse human health or environmental effects on minority or low-income populations that result from Federal actions. Table 4-7 presents population demographics relevant to consideration of environmental justice concerns.

Table 4-7. Comparison of Demographics for Geographic Areas in 2000

CHARACTERISTIC	GEOGRAPHIC AREA		
	USA	OKLAHOMA	ROGERS COUNTY
Population under 5 years	6.8%	6.8%	6.9%
Population over 65 years	12.4%	13.2%	11.3%
White persons	75.1%	76.2%	79.9%
Black persons	12.3%	7.6%	0.7%
Native American persons	0.9%	7.9%	12.1%
Asian persons	3.6%	1.4%	0.3%
Hispanic or Latino persons	12.5%	5.2%	1.8%
Population change, 1990-2000	13.1%	9.7%	28%
Median household income	$37,005	$30,002	$41,466
Persons below poverty	13.3%	16.3%	9.1%
Children below poverty	19.9%	23.7%	14.1%

As shown in the Table, the demographics of Rogers County indicate an area of relatively high population growth since 1990 and an area of relatively high household income. Poverty levels of individuals and children in Rogers County are substantially lower than levels for the U.S. and Oklahoma. The one

population segment for Rogers County that displays a distinctly high characteristic that must be considered is the population of Native Americans. The Cherokee Nation is the predominant Native group in this population. Section 4.15 discusses consultations with the Cherokee Nation regarding the proposed development of the Tulsa Port of Catoosa site for the GTL plant, which resulted in this Native American group providing documentation of no objections.

The proposed plant is considered to represent an activity that would not result in any disproportionate adverse impact to low-income or minority populations.

4.20 UNAVOIDABLE ADVERSE EFFECTS

The proposed plant could result in short-term to long-term impacts to the site. Many of the potential adverse impacts described in the preceding sections would be avoided as part of the planning for the proposed project or have a remote chance of occurring. However, potential impacts could occur, and the following list of primary unavoidable impacts would be anticipated:

- Increase in noise levels during construction (short duration), operation, or demolition
- Potential short-duration increase in airborne dust and particulate during construction or demolition and a similar localized, but permitted, increase in air emissions during operation
- Loss of biological resources from localized destruction of site woodlands during construction, which would be an unavoidable long-term effect of the proposed project

5.0 REGULATORY COMPLIANCE

5.1 FEDERAL REQUIREMENTS

This EA was prepared in accordance with the NEPA, the CEQ regulations, and the DOE's NEPA Implementing Procedures. A brief summary of key laws, regulations, executive orders, Federal permits, and licenses that may be applicable to the proposed project is provided in the following paragraphs.

5.1.1 Environmental Policy

The NEPA of 1969 (42 United States Administrative Code [U.S.C.] p. 4321 *et seq*.) establishes a national policy to encourage harmony between man and his environment and to promote efforts to prevent, mitigate, or eliminate damage to the environment and stimulate the health and welfare of man. NEPA procedures ensure that environmental information related to Federal action is made available to public officials and citizens, and that the environmental information, along with public input, is considered in the Federal decision-making process.

Executive Order 11514, Protection and Enhancement of the Environmental Quality, as amended by Executive Order 11991, sets policy for directing the Federal government in providing leadership in protecting and enhancing the quality of the Nation's environment. The CEQ Regulations (40 CFR 1500 to 1508) implement the procedural provisions of the NEPA. DOE's NEPA Implementing Procedures (10 CFR 1021) establish the specific procedural requirements for DOE implementation of NEPA.

5.1.2 Biological Resources

The Endangered Species Act (16 U.S.C. 1531 – 1544) requires Federal agencies to determine the effects of their actions on threatened or endangered species of fish, wildlife, and plants, and their critical habitats and to take steps to conserve and protect these species. Executive Order 11990, Protection of Wetlands, requires Federal agencies to take action to avoid or minimize the destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands.

5.1.3 Public Health

Executive Order 12088, Federal Compliance with Pollution Control Standards, directs Federal agencies to comply with Federal, state and local laws and regulations concerning air, water, noise pollution, and hazardous materials and substances to the same extent as any private party.

5.1.4 Environmental Justice

Executive Order 12898, requires that each Federal agency make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority or low income populations.

5.1.5 National Historic Preservation Act – Section 106 Compliance

Cultural resources (archaeological and historical sites and structures) must be examined according to Section 106 of the National Historic Preservation Act and implementing regulations at 36 CFR 800, in addition to review under NEPA. Significant historical and archaeological properties and sites that may be

impacted by a proposed action or alternatives must be identified. Significant sites are defined as those listed on, or determined eligible for listing on, the National Register of Historic Places (NRHP).

The Oklahoma State Historic Preservation Officer (SHPO) must be consulted regarding impacts to significant resources and means to mitigate the impact, if necessary. If significant resources are identified and potential impacts defined, any necessary mitigation measures are stipulated in a Memorandum or Agreement. Depending on the resources encountered, Native American Indian groups may also be consulted.

5.16 Toxic Substances Control Act

The Toxic Substances Control Act mandates EPA approval of manufactured or imported chemical substances that could potentially pose an environmental or human health hazard. Fuels produced from a GTL plant would constitute chemical substances for which EPA review, screening, and tracking would be implemented.

5.17 Resource Conservation and Recovery Act

This Act provides authority for EPA to control hazardous substances from "cradle to grave." Regulatory requirements under the Act cover generation, transportation, treatment, storage, and disposal of hazardous waste, and management of non-hazardous waste.

5.2 STATE REQUIREMENTS

- OAC 252:100-3 (Air Quality Standards and Increments)
  Air emissions shall not cause exceedences of National Ambient Air Quality Standards on land outside the permitted facility.

- OAC 252:100-4 (New Source Performance Standards)
  The State of Oklahoma has adopted Federal regulations at Title 40, Code of Federal Regulations, Part 60.

- OAC 252:100-5 (Registration, Emission Inventory, and Annual Operating Fees)
  An annual inventory of air emissions must be filed with the State of Oklahoma DEQ.

- OAC 252:100-7 (Permits for Minor Facilities)
  Construction permit # 2001-006-C was issued to Syntroleum Corporation on July 2, 2001, by the Oklahoma DEQ, as authorization to construct the proposed gas-to-liquids fuels production and demonstration plant at Catoosa, Oklahoma.

- OAC 252:100-7-18(a) (Permits for Minor Facilities)
  The recipient of a construction permit must apply for a permit to operate within 60 days following the first day of operation.

- OAC 252:100-19 (Control of Emission of Particulate Matter)
  Particulate emissions from new fuel-burning equipment with heat input of 10 MM Btu/hr or less shall not exceed 0.6 lb/MM Btu.

- OAC 252:100-25 (Smoke, Visible Emissions and Particulates)
  Discharges exceeding 20% opacity shall not be permitted, except for limited, short-duration occurrences.

- OAC 252:100-29 (Control of Fugitive Dust)
  No visible fugitive dust that damages or interferes with use of adjacent properties or that causes air quality standards to be exceeded shall be discharged.

- OAC 252:100-31 (Control of Emission of Sulfur Compounds)
  Sulfur oxide emissions from new gas-fired fuel burning equipment shall not exceed 0.20 lb/MM Btu heat input.

- OAC 252:100-33 (Control of Emission of Nitrogen Oxides)
  Nitrogen oxide emission limits are established for new fuel burning equipment that has a rated heat input of 50 MM Btu/hr or greater. Since the fuel burning equipment in the proposed facility would be substantially smaller in size, this regulation would not apply.

- OAC 252:100-37-15(b) (Control of Emission of Volatile Organic Compounds)
  Volatile organic compound (VOC) storage tanks containing a liquid with a vapor pressure of 1.5 psia or greater and with capacities exceeding 400 gallons shall be equipped with a permanent submerged fill pipe or an organic material vapor recovery system.

- OAC 252:100-37-36 (Control of Emission of Volatile Organic Compounds)
  All fuel-burning equipment shall be properly operated and maintained to minimize VOC emissions.

- OAC 252:100-41 (Control of Emission of Hazardous Air Pollutants and Toxic Air Contaminants)
  Sources of low toxicity substances with *de minimus* emissions of 6 tpy, but not to exceed a maximum rate of 5.6 lb/hr, are exempt.

- OAC 252:520 (Solid Waste Management)
  Requirements for management, including generation, collection, transport, or disposal of solid waste, including non-hazardous industrial waste and hazardous waste, are established. Generators disposing of more than 10 cubic yards of non-hazardous industrial waste in a calendar month are required to maintain a tracking document for each transported load of waste. Regulations require that no hazardous waste shall be disposed in any solid waste disposal facility in Oklahoma.

- OAC 252:605 (Discharge Standards)
  Standards are established for point source and stormwater discharges to waters of the State of Oklahoma, including implementation of the Oklahoma Pollutant Discharge Elimination System (OPDES). New discharges of stormwater from an industrial activity to waters of the State are prohibited, except as authorized by an individual OPDES permit or an authorization under an Oklahoma General Stormwater permit. The State of Oklahoma has adopted the Federal stormwater regulations, which provide that an oil or gas processing facility is not subject to stormwater permit requirements, unless, for example, the facility has experienced a discharge of a reportable quantity of material (40 CFR Part 122.26(c)(1)(iii).

5.3 LOCAL REQUIREMENTS

- The Tulsa Port of Catoosa has established Building and Development regulations. These regulations are incorporated into leases for Industrial Park sites and can be viewed at 'www.tulsaport.com/f.indsite.html'

6.0 SECONDARY AND CUMULATIVE EFFECTS AND LONG-TERM ENVIRONMENTAL CONSEQUENCES OF THE PROPOSED ACTION

6.1 SECONDARY EFFECTS

Secondary, or indirect, effects caused by actions are effects that occur later in time or farther removed in distance, but which are reasonably foreseeable. Indirect effects may include growth-inducing effects and other effects related to induced changes in the pattern of land use, population density, or growth rate. The project, as proposed, considers effects associated with product fuel utilization and employment increases at the Tulsa Port of Catoosa. No other secondary effects would be expected.

6.2 CUMULATIVE EFFECTS

A cumulative impact, as defined by the CEQ (40 CFR 1508.7) is the "impact on the environment which results from the incremental impact of the action when added to other past, present and reasonably foreseeable future actions regardless of which agency (federal or non-federal) or person undertakes such actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time."

Cumulative noise impacts in the proposed plant area may result from continued development of the Port. While the proposed project would be limited by lease criterion to a maximum increase in property line noise levels of 4 dB, which is the human limit of discernable difference, reasonably foreseeable and unrestricted development of nearby tracts could progressively increase this background noise level over time. While additional development is possible in the future, the Port's guidelines and lease provisions for property line noise limits would address this issue.

6.3 LONG-TERM ENVIRONMENTAL CONSEQUENCES

The proposed action, if supported, would result in establishing a plant with the capability to produce about 70 bpd of GTL ultra-clean liquid fuels. Upon completing the anticipated 6-month, DOE-sponsored operating program to produce fuels for the engine and fleet vehicle demonstration programs, Syntroleum could continue operating the GTL plant. Under those circumstances, the scale of operations would not be expected to change. Capacities would be limited by the established equipment sizes, and the lease arrangement with the Tulsa Port of Catoosa would be restricted to the 10-acre site, which would be substantially developed to accommodate the project as proposed. For long-term operation of the proposed plant, no new environmental consequences would be anticipated.

7.0 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

NEPA regulations require the evaluation of irreversible and irretrievable commitments of resources associated with Federal actions. Construction and operation of the proposed plant would result in the irretrievable commitment of biological resources (existing woodlands), materials, energy, fuel, and labor effort.

Resources committed for GTL plant construction would include structural steel, concrete, pipe, wiring, instrumentation, and process equipment, including vessels, tanks, pumps, compressors, valves, etc. These components would be considered to represent irretrievable resource commitments for the proposed project. Although the exact quantities have not yet been identified, the relatively small size of the proposed GTL plant would not be expected to constrain supplies of these components for other uses.

Resources committed to GTL plant operation would include the following:

- Natural gas 434 MM SCF
- Nitrogen 0.96 MM SCF
- Hydrogen 14 MM SCF
- Electricity 6,030 MW hours
- Water 52,594 barrels

Commitment of these raw materials for plant operation would not be expected to have an adverse effect on supplies of these materials for other uses.

The biological resource (10-acre parcel of land) that would be committed for plant construction would represent an irretrievable commitment of resources. This commitment would not, however, be expected to have an adverse effect on regional ecology or habitat for regional flora or fauna.

The labor commitment for construction and operation of the GTL plant would be relatively small and easily accommodated from the local metropolitan areas. Neither the short-duration construction effort nor the increase in operating labor created by the proposed plant should adversely impact the size of the local labor pool.

8.0 ENVIRONMENTAL CONSEQUENCES OF THE NO ACTION ALTERNATIVE

Under the No Action Alternative, the DOE would not contribute funds to support construction and initial operation of the GTL fuels production plant. Due to the substantial share (44%, or $16 million) of project costs that would not be provided by DOE under a No Action decision, the industrial participants would not be expected to continue near-term plans for the proposed project. As a result, the existing site conditions for the 10-acre property at the Tulsa Port of Catoosa Industrial Park would remain unchanged. The Port would, however, continue efforts to lease the property to other industrial users.

Under the No Action Alternative, the industrial participants would be expected to pursue other sources of funding for the proposed project. If successful, the environmental consequences would be expected to be similar to those identified in this Environmental Assessment.

9.0 SIMILAR ACTIONS AND ACTIONS BEING CONSIDERED UNDER OTHER NEPA REVIEWS

The proposed action, for DOE support in establishing a plant to produce ultra-clean diesel fuel for performance testing in engines and fleet vehicles, is not similar to any other action being considered (or currently being implemented) by DOE. This action is not a segment of any other action for which review under NEPA would be required.

10.0 RELATIONSHIP OT THE PROPOSED ACTION TO APPLICABLE LAND USE PLANS AND POLICIES

The proposed action would result in construction and operation of a gas-to-liquids fuels production plant on a 10-acre parcel of land at the Tulsa Port of Catoosa Industrial Park in Rogers County, Oklahoma. Land use for the proposed facility would be strictly controlled by a standard agreement developed by the Tulsa Port of Catoosa for industrial tenants on leased parcels of land within the 2,000-acre Industrial Park.

Lease agreements for entry into the Industrial Park contain specific provisions and restrictions covering at least the following topics:

- Environmental restrictions
- Noxious or offensive activities
- Pollution prohibition
- Height limitations
- Locations of structures
- Landscaping and parking
- Loading docks
- Power installations
- Storage of bulk commodities
- Signs

All site plans would require review and approval by the Tulsa Port of Catoosa staff, which has authority to establish recommended changes or modifications that must be implemented for lease approval. Site and construction plans must be reviewed and approved by the City of Claremore-Rogers County Planning Commission. Section 3.3.1.2 of this Environmental Assessment identifies the types of commercial and industrial operations that are currently approved and on-going within the Park. The proposed action to establish a GTL plant on the 10-acre site in the Industrial Park would be consistent with established land use plans and policies for properties within the Tulsa Port of Catoosa Industrial Park.

11.0 CONSULTATION AND PUBLIC PARTICIPATION

11.1 AGENCY CONSULTATION CORRESPONDENCE

The agencies and organizations contacted during environmental analysis of the proposed project are identified in Table 11-1, and the correspondence that documents the contacts and any responses are reproduced in Appendix A.

Table 11-1. Agency and Organization Contacts

NO.	AGENCY CONTACTED	DATE	AUTHOR	DATE OF AGENCY RESPONSE	AUTHOR
1a	Oklahoma Archeological Survey			02/28/2001	Hurst
1b				03/28/2001	Brooks
1c		01/28/2002	Lorenzi; DOE		
1d				01/29/2002	Carmichael
2	Cherokee Nation			03/19/2001	Gwin
3a	Oklahoma Historical Society			03/15/2001	Heisch
3b		12/21/2001	Lorenzi; DOE		
3c				01/23/2002	Heisch
4	Oklahoma Natural Heritage Inventory			03/01 /2001	Elam
5a	U.S. Fish & Wildlife Service	12/21/2001	Lorenzi; DOE		
5b				01/29/2002	Brabander

11.2 PUBLIC PARTICIPATION

[This section is reserved for the Final Environmental Assessment.]

12.0 REFERENCES

Council on Environmental Quality – Regulation 1506, Section 1506.6 Public Involvement, http://ceq.eh.doe.gov/nepa/regs/ceq/1506.htm.

Cherokee Nation, Letter of Review Re: Project #53017001, March 19, 2001.

Cojeen Archaeological Services, Report on the Archaeological Survey of the Terracon Proposed 10-Acre Storm Water Discharge Area, Located in Rogers County, Oklahoma, March 24, 2001.

Department of Energy, 10 CFR 1021, National Environmental Policy Act Implementing Procedures Final Rule, http://tis.eh.doe.gov/nepa/tools/regulate/nepa_reg/57fr15122.htm.

Environmental Questionnaire, B. J. Russell, Solicitation Number DE-PS26-00NT 40758, Jan 8, 1998.

EPA-452/R-95-017, Protocol for Equipment Leak Emission Estimates, U.S> Environmental Protection Agency.

Federal and State Endangered, Threatened and Candidate Species in Oklahoma by County, Oklahoma Natural Heritage Inventory, May 19, 1999.

Geological Provinces of Oklahoma, R.A. Northcutt and J.A. Campbell, Oklahoma Geological Survey.

Leonard Cheslock, URS Corporation, Memorandum, Subject: Syntroleum Environmental Assessment – Background Noise Assessment, September 12, 2001.

National Wetlands Inventory, U.S. Department of the Interior, Fish & Wildlife Service, Catoosa, Oklahoma – Map No. 3695-213.

Oklahoma Archeological Survey, Letter of review RE: Terracon proposed General Permit-005A, February 28, 2001.

Oklahoma Archeological Survey, Letter of review Re: Proposed Stormwater Discharge, March 28, 2001.

Oklahoma Department of Environmental Quality, Permit No. 2001-006-C, to Construct a Gas-to-Liquids Fuels Production and Demonstration Plant at a Site in Catoosa, OK, July 2, 2001.

Oklahoma Geological Survey, A Brief Geologic History of Oklahoma, http://www.ou.edu/special/ogs-pttc/earthsci/geohist.htm

Oklahoma Historical Society, Letter of Review Re: File #1221-01, March 15, 2001.

Oklahoma Natural Heritage Inventory, Letter of Review Re: Project No. 53017001: Construction Storm Water Pollution Prevention Plan, March 01, 2001.

Port of Catoosa Land Lease – Noise Demonstration, R.A. Mitchell, Syntroleum Corporation, April 2, 2001.

Phase I, Environmental Site Assessment, L.Q. Farmer, Environmental Evaluations, Inc. January 15, 2001.

U.S. Department of Commerce, Census Bureau, http://www.census.gov/index.html.

U.S. Department of Interior, Geological Survey, 7.5-Minute Series Topographic Map, Catoosa Quadrangle, 1980.

U.S. Environmental Protection Agency, Compilation of Air Pollutant Emission factors, AP-42, Fifth Edition, Volume I: Stationary Point and Area Sources.

U.S. Geological Survey Water-Supply Paper 2275, National Water Summary – Oklahoma, Oklahoma Ground-Water Resources, J.S. Havens & M.V. Marcher, 1983.

U.S. Fish & Wildlife Service, County Lists of Federally Listed Species of Oklahoma, Roger County, http://ifw2es.fws.gov/Oklahoma/ctyspp.htm

US Fish & Wildlife Service, 1996 National List of Vascular Plant Species That Occur in Wetlands, http://www.nwi.fws.gov/bha/196_intro.html

Appendix A

Agency Consultation Correspondence